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CONTENTS.

☞ An asterisk (*) denotes an illustrated article

EDITORIALS—
The London Treatise on the Manufacture of Coal Gas.209
The Naphtha Explosion near the New York Metropolitan Gas Works.....205
Exhibition of Gas Utensils.....209
The Lowe Process.....209
Report of the Paris Gas Co.....206
Lecture on Illuminating Gas.....208
Report of the Department of Public Works for the Quarter ending Dec. 31, 1873, Bureau of Lamps and Gas.....210
Discussion on House Drainage.....212
Chemical and Scientific Repertory.....213
Public Liberality.....213
Street Lamps in London.....213
American vs Provincial Gas Coals.....213
The Electric Light.....213
CORRESPONDENCE—
Testing Meters.....214
The Economical Application of Gas.....214
Proposed Standard Photometer for Measuring the Illuminating Power of Gas.....214
Gas-Light Intelligence.....215
Fire-Clay.....216
Prices of Gas Coals.....193
A New Motor.....216

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THE LONDON TREATISE ON THE MANUFACTURE OF COAL GAS.

This work is now being issued in monthly numbers, and will be one of the most valuable compendiums of information bearing upon the history and the science and practice of gas manufacture yet published. Every gas manager should have it. It is issued in paper covers, so that it can be bound to suit the taste of the subscriber. The issue will occupy about two years. The price of each number, if furnished from this office, is 40 cents a number, or $4.80 a year.

We have already received many subscriptions, and we would urge all those who have not yet sent us their names to do so at once. We propose to send bills for the first 12 numbers upon receipt of subscription.

THE NAPHTHA EXPLOSION NEAR THE NEW YORK METROPOLITAN GAS WORKS.

On Monday, May 28th, an explosion took place near the works of the Metropolitan Gas-Light Company, foot of 42d street and North river, which resulted in the death of three persons, and the severe injury of a fourth, the latter being the only employee of the gas company that suffered.

The facts of the case are as follows:—A lighter came to the company's dock to deliver a cargo of naphtha. The usual method is to deliver the naphtha from a tank barge by means of a hose attached to the company's pump, by which the oil is forced into tanks on the company's premises; but, for some reason or other, on this occasion the cargo, consisting of about 100 bbls. of naphtha, was brought in barrels, and not in bulk, in the hull of the vessel. To enable the company's pump to receive it the contents of the barrels, after removing the bungs, was run into a large cask or hogshead, by means of an open trough, and then the hose was put into this cask and the pump started. No sooner had the pump been set in motion than an explosion was heard and the whole mass was in a blaze. The energetic action of the company's officers, in applying the fire hose, saved what otherwise would have been a very serious conflagration, probably resulting in the destruction of the trestle work and coal sheds which were adjacent. The three men who were killed belonged to the boat. The Coroner is giving the matter a thorough investigation, and his report *may* throw some light on the cause of the sad accident, which, from all that can now be gathered, was undoubtedly a match or lighted pipe in use by some of the boat's crew. We are told that naphtha is perfectly safe. So it *may* be, if nothing happens to set it off. But, certainly, any such method of handling it, and pouring it about loosely, is not to be commended. This matter, however, would seem to be something entirely beyond the control of human intelligence. Men get perfectly careless after constant handling of any dangerous material, and if the captain of a lighter sees fit to go sailing up the North river with a lighted pipe in his mouth, and the air about him full of naphtha vapor, it is somewhat questionable if any one is very anxious to go near enough to him to knock the pipe out of his mouth. From all that we can learn in this case every precaution is taken, in the handling of the material, by the company, after they get it in their possession; but does the risk and danger involved in the use of naphtha as enricher pay? It would seem that, at the present price of coal, there must be an enormous margin of profit in using oil to compensate for the anxiety and danger, both to life and property, which must inevitably accompany it.

EXHIBITION OF GAS UTENSILS.

We call the attention of our readers to the account in another column, of an exhibition in South Shields, England, of gas stoves, heaters, &c. &c., Why would it not be a good idea for the American Gas-Light Association to institute something of a similar nature, offerring liberal inducements in the way of medals, &c. The exhibition might be held in connection with the annual meetings, thus giving gas men from all over the country an opportunity to see collected together all the different appliances for using gas for other than illuminating purposes. Proper regulations could be easily established for the management of the exhibition, so that an award from the Association would be of real value. Let the Executive Committee move in this matter.

THE LOWE PROCESS.

We regret that a very interesting communication from Mr. Dwight upon this subject is unavoidably crowded out of this issue, but it will appear on June 16th.

Report of the Paris Gas Company.

[*Le Gaz.*]

The following Report of the Company's operations for the year 1876 was presented by the Board of Direction at the Annual General Meeting held in Paris on the 29th of March:—

Gentlemen,—In conformity with Article 23 of our statutes, we present to you our report on the company's operations for the year 1876, and acquaint you with the position of our undertaking on the 31st of December last.

During the year which has just passed away considerable progress was made in the consumption of gas. We should have been pleased to inform you that our profits had taken the same upward course; but different causes, the effects of which it has not depended upon us altogether to mitigate—notably the increase in the price of labor, the diminution in the value of silver, the exceptionally mild temperature which prevailed during the entire winter and suspended the sale of coke—have prevented us from attaining that result. We have, however, the satisfaction of announcing to you that we are in a position to pay you a higher dividend by 2 frs. than that for the year 1875.

GENERAL REVIEW OF THE COMPANY'S OPERATIONS.

Consumption of Gas.—During the past year, our works, ten in number, sent out for consumption a volume of gas equal to 189,209,789 cubic metres (rather over 6679 million cubic feet), being 13,271,545 cubic metres (nearly 468½ million cubic feet) more than in 1875.

This annual increase is lower than that for the year 1875, which reached 15,286,042 cubic metres (539,597,000 cubic feet), but it considerably exceeds the annual increase of preceding years, which has always varied between 6 and 8 million cubic metres (between 212 and 282 million cubic feet).

The day consumption, which takes place between the time for extinguishing and the time for relighting the public lamps, figures in the above total of 189,209,789 cubic metres to the extent of 39,301,042 cubic metres (1,387,326,000 cubic feet), and exceeds by 6,131,947 cubic metres (216,458,000 cubic feet) the corresponding amount for the year 1875.

Receipts for Gas.—The produce of the sale of gas amounts to 46,248,120 frs. (about $9,250,000), exceeding by 6·38 per cent., the analogous receipts for the year 1875.

Consumers.—The number of consumers on December 31st, 1876, was 117,790, exceeding by 6569, or 5·90 per cent., the number at the same date in 1875. Of these 6569 new consumers, 4325, or nearly two-thirds, are supplied from the house services.

This proportion is very nearly the same as that for the year 1875 which produced us 6542 new consumers, of whom 4230 were supplied from the house services.

Public Lighting.—The number of public lamps in use on the 31st of December last was as follows:—

In Paris	21,191
In the environs	13,032
In the outskirts	5,957
Total	40,180

exceeding by 773 the number in use on Dec. 31st, 1875. These additional lights may be distributed as follows:—

In Paris	144
In the environs	443
In the outskirts	186
Total	773

*House Services.**—These have become one of the most important branches of the company's operations. In our previous reports we have explained the methods by which we seek to increase the number of house services, and to render them more productive. These means, however, are still but little known, and in spite of our efforts to place gas within the reach of consumers, many persons are even now ignorant as to how they may procure it. We think, therefore, that, without repeating details contained in previous reports, it might be useful to profit by the publicity that will be given to the present one, to recapitulate the conditions on which the company undertake the gratuitous laying on of these services.

The company will gratuitously lay on a house service with the branch-pipes connected therewith, in every house, either new or inhabited, the landlord of which undertakes, at his own expense, to make the necessary preparations for at least three lights in three apartments; and in order to compensate him in some measure for the expense attending this work, the company award him, once for all, a premium of 100 frs.. When the landlord has the gas laid on to more than three apartments, the company add to this a further premium of 30 frs. for each three lights beyond the three required by their regulations.

A premium of 30 frs. is also awarded to every person, whether landlord or lodger in a house provided with a gas service, who for the first time brings into use an unproductive branch-pipe, by making, at his own expense, provision for the introduction of three gas-lights into an apartment.

When the company lay on a service to a house already inhabited, for the purpose of supplying gas in an apartment the lighting of which they consider will be sufficiently remunerative, they award the landlord who has been at the expense of fitting up the three burners a premium of 30 frs. In this case, however, he has no right to the premium of 100 frs.

Lastly, the company award a premium of 40 frs. to any workman, approved by them, who, at his own expense, risk, and peril, and on the condition that he relinquishes them gratuitously to the landlord, shall provide fittings for two lights on a branch previously unproductive, belonging to certain determined groups of pipes.

Such is the system of premiums actually in use, and the application of which has had the effect of raising, in the course of ten years, the annual income from the sale of gas supplied to consumers by means of these house services from 829,715 frs. to 5,389,372 frs. ($165,943 to $1,077,875).

We will now, gentlemen, lay before you an account of the results obtained from these services in 1876. During that year the company laid on 1386 house services, 113 on the application of landlords, and 1273 on the application of lodgers. Consequently, the total number in use on Dec. 31st last had been increased to 9257. This represents very nearly double the number existing on Dec. 31st, 1872, or four years previously. These 9257 services, exclusive of their branch-pipes, taps, and meters, which are subject to a special payment, in conformity with police arrangements and the consumers contracts, cost 5,394,967 frs., which corresponds to an average cost of 583 frs. (about $117.) per service, being about equal to the average of 585 frs. stated on Dec. 31, 1875.

The receipts arising from the sale of gas supplied by these services in 1876 amount, as stated above, to 5,389,372 frs., showing an increase of 869,647 frs. ($173,930), or 19·2 per cent., on the analagous receipts for the preceding year.

With regard to the number of consumers supplied from the house services, which on Dec. 31, 1875, was 22,480, at the corresponding date last year it had attained the figure of 26,805, representing a little over one-fifth of the total number of consumers.

Principal Results of Working.—The following table gives the quantity of gas manufactured from Jan. 1, 1856 to Dec. 31, 1876. It shows that during a period of 21 years the total increase has been 148,435,389 cubic metres (about 5240 million cubic feet), or 364 per cent., the average annual increase having been 7,068,351 cubic metres (349½ million cubic feet):—

Year.	An. Consumption. Cubic Metres. (1 c. m.=35·317 c. ft.)	An. Increase. Cubic Metres. (1 c. m.=35·317 c. ft.)	Annual Dividends. Francs.
1855	40,774,400	—	—
1856	47,335,475	6,561,075	40·00
1857	56,042,640	8,707,165	45·00
1858	62,159,300	6,116,660	50·00
1859	67,628,116	5,468,816	60·00
1860	75,518,922	7,890,806	70·00
1861	84,230,676	8,711,754	70·00
1862	93,076,220	8,854,544	85·00
1863	100,833,258	7,757,038	95·00
1864	109,610,003	8,776,745	105·00
1865	116,171,727	6,561,724	105·00
1866	122,334,605	6,162,878	110·00
1867	136,569,762	14,235,157	115·00
1868	138,797,811	2 228,049	120·00
1869	145,199,424	6,401,613	102·00 *
1870	114,476,909	30,722,520 dec.	40.50 †
1871	87,481,346	26,995,558 "	32·50
1872	147,668,331	60,186,985	51 00
1873	154,397,118	6,728,787	52·50
1874	160,652,202	6,255,084	55·00
1875	175,938,244	15,286,042	60·00
1876	189,209,789	13,271,545	62·00

Manufacturing Power.—The manufacturing plant upon the company's works at the end of last year represented a daily producing power of 935,000 cubic metres (39 million cubic feet). Looking forward to an increase in consumption equal to that of the year 1876, we reckon on raising our producing power this year to 996,000 cubic metres daily (rather over 35 million cubic feet), which corresponds very nearly to an annual make of 220 million cubic metres (7766 million cubic feet). The available plant comprises, as usual, a reserve of 10 per cent., which is required in case of accident, and to meet any unforeseen increase in consumption.

Canalization.—Dunrig the past year important canalization works were carried out, for the purpose of extending or improving the distribution, and bringing more directly to the center of Paris the gas made at the company's station at the Barriere d'Italie.

The total length of new mains laid was 28,774 metres, apportioned as follows:—

	Metres.	Yards.
In Paris	7,851	8,583
In the environs	11,809	12,911
In the outskirts	9,114	9,865
Total	28,774	31,459

The total length of mains laid under the public roadways on the 31st of December last had consequently been increased to 1,704,245 metres, apportioned as follows:—

	Metres.	Yards.
In Paris	701,689	767,180
In the environs	525,240	574,262
In the outskirts	477,316	521,865
Total	1,704,245	1,863,307

* These house services, called *conduites montantes*, are pipes carried from the bottom to the top of the building, for the supply of flats and separate apartments, as in Scotland.

* This was the first year in which a division of profits exceeding 12,400,000 frs. took place with the Municipality of Paris.

† As in this year the shares were divided, these figures must be multiplied by 2 to render them comparable with those of the preceding years.

The greater portion of the main-laying work was undertaken, as usual, at the request of the municipal authorities, or in the execution of our contracts with the communes of the districts beyond the fortifications, as well as upon the requisition of privtae persons whose consumption ensured us a sufficient return for the outlay incurred.

We have recently negotiated with the commune of Montmagny a lighting contract, which is at present awaiting the approval of the *Administration Superieure*. The conditions of this contract are exactly the same as those contained in contracts entered into with the other communes, and like them will expire with our concession on Dec. 31, 1905. When this contract comes into operation, the number of communes lighted by the company, in the departments of the Seine and Seine-et-Oise, will be fifty.

FIRST ESTABLISHMENT CHARGES.

Property Acquired.—When we consider the rapid increase that has taken place in the consumption of gas, especially during the past two years, we are naturally led to ask whether the company, whose works already occupy a superficial area of 66 hectares (163 acres), possess sufficient land to give to their undertaking all the extension it requires, and allow it perfect freedom for development.

The acquisitions of land which have taken place during the past year, on very advantageous conditions, afford us the means of providing in a great measure for the future requirements of our works.

Works and Plant.—You know, gentlemen, that every year we are obliged to augment our productive power, in order to keep it in a condition to meet the probable exigencies of the consumption in the last days of December.

In 1876 this obligation was forced upon our attention much more strongly, seeing that we had not only to provide, as in 1875, for an increase in consumption double that of preceding years, but moreover to augment our reserve plant, which, at the end of that year, was no longer in proportion to the plant in operation.

ACCOUNT OF FIRST ESTABLISHMENT CHARGES FOR THE YEAR 1876.

Expended for—

Purchase of land and extension of works, etc	$ 272,691
Works and plant	1,211,898
Mains, services, fittings, etc	636,053
Total	$ 2,120,642
Less value of works replaced and land sold	318,003
Total expended for year 1876	$ 1,802,639
" " to Dec. 31, 1875	30,602,258
Total establishment charges	$32,404,897

Against which the capital of the company is a follows:

In shares, 84,000,000 frs. =	$16,800,000
In bonds, 85,145,739 frs. =	17,029,148
Total capital	$33,829,148

WORKING ACCOUNT FOR 1876.

Expenditures.

Gas on hand Jan. 1, 1876	$ 2,151
Materials used—coal, coke and tar.	4,239,291
Salaries, wages, maintenance, purifying material, incidental and general expenses	977,200
Cost of distribution and general management	1,897,511
Municipal and state charges	869,512
Total Expenditure	$7,985,665

REVENUE.

Sales of gas	$ 9,256,824
Value of gas in store Jan 1	5,328
Retort coke	2,999,806
Furnace coke	106,402
Tar	513,580
Ammoniacal liquor	61,202
Compressed fuel	2,295
Rent of meters	186,481
" fittings, etc	183,879
Firebrick	50,236
Chemical products	186,091
Sundry works	20,123
Interest and discount	125,428
Total Revenue	$13,697,585
Balance being profit of 1876	5,711,517
" from " " 1875	110,246
	$ 5,821,763
Deduct for outstanding claims	21,763
Profit available for distribution	$ 5,800,000
Deduct for share dividend	2,480,000
Balance divisible equally between City of Paris and thareholders.	$ 3,320,000

The total amount available for distribution among the stockholders is, therefore, as follows:

Dividend, as per above	$ 2,480,000
Moiety of balance	1,660,000
4th payment by city on account of loan	10,000
Balance of profit, 1875	76,121
Total	$4,226,121
Deduct 1 franc per share for special reserve fund as authorized March, 1875	67,200
Balance	$ 4,158.921
Deduct dividend paid Oct. last (12 frs. 50 centimes)	797,440
	$ 3,361,481
Deduct final dividend 49 francs 50 centimes, making total dividends for year, 62 frs. per share of 250 francs	3,326,400
Nett balance carried forward	$ 35,081

PROVIDENT AND OTHER FUNDS.

Provident Fund.—During the year 1876 the medical staff visited at their homes 1675 of the company's servants who were absent on account of sickness, and attended 22,375 consultations. The medical fees, medicines, baths, and instruments, half salaries, and funeral expenses, caused an expenditure of 236,279 francs ($47,256.)

Pension Fund.—The amount placed to the credit of this fund since its formation, including interest and balance realized on last drawing of bonds, reached on Dec. 31st last a total of 1,336,-431 francs.

The disposable balance, augmented by the grant made to the fund for the first half of the year 1877, will be employed in paying off the fourth instalment on 1190 bonds not fully paid up, and in the purchase of fresh securities. Supposing that these can be purchased at about par it will be seen that the annual revenue of the pension fund will, on the first of July next, amount to about 70,000 francs ($14,000), after deducting tax.

Special Reserve Fund.—This fund, the formation of which was authorized by you in conformity with Article Forty of the statues, was founded with the object of securing to the completed shares, at the end of the concession, a capital of equal value to the share which the City of Paris will then take of the company's assets. It is augmented every year by means of a levy to the extent of one franc per share upon the shareholders profits, and to this is added the interest on former levies. You further decided that the annuity of 210,296 francs ($42,059) due to the company by the City of Paris, in execution of Article 4 of the treaty of April 27, 1872, should be added to it. This annuity, the repayment of which is to be deferred till 1898, represented on Dec. 31st last a credit, in capital and interest, of 906,833 francs ($181,366.)

In July next the special reserve-fund will be in possession of 2980 fully paid bonds of 400 francs, producing, after deducting the tax of three per cent., an annual interest of 57,800 frs. ($11,560.)

LABOR, MATERIALS, RESIDUALS, ETC.

Laoor.—In 1876 the price of labor underwent a further advance, and, in order to retain our workpeople, we were obliged to raise the salaries of a certain number of them. But you are aware, gentlemen, that we do not confine ourselves to considering these augmentations of salaries as a necessity commanded by circumstances, but that we make it our duty to endeavor, at the same time, to give them a tendency to a useful and moral end. Thus we have successively added to the fixed salaries of our special workmen a variable sum proportionate to the amount of work performed, and a premium, called a "premium for punctuality," because it is awarded exclusively to those men who have not absented themselves without leave during the month.

Savings-Fund.—While ameliorating the material condition of our workmen, we proposed also to inspire in them habits of thriftiness, and to afford them facilities for putting away, without expense or loss of time, whatever money they might be able to save each month out of their earnings. We have thus been led to establish a savings-fund, the object of which is to render productive the smallest sums deposited in it. This fund has been in existence since the first of July last, and has worked with the greatest simplicity on the following conditions:—

The deposits are entered in a small book in the name of the depositor, and bear interest at the rate of 5 per cent. per annum. The interest is made up in periods of six months, no fractional parts of such periods being considered, and added to the capital previously deposited.

The sums deposited, whether at one time or successively, must not exceed 500 frs. When they reach that amount the company undertake to purchase, with the consent of the depositors, and without any expense to them, some of the following stock, the vouchers for which are at once transmitted to them:—French Three per Cents.; 3 per cent. Bonds of the Eastern, Northern, Western, Lyons, and Orleans Railways; or 5 per cent. Bonds of the Paris Gas Company.

All the company's servants, permanent or temporary, are admitted to a participation of the benefits of this institution, the operations of which may be summarized as follows:—

		Francs.	
In the second half of 1876, 2392 accounts were opened, and there was received on deposit a total sum of		152,993	$30,600
Out of this sum there was repaid in cash to 141 depositors leaving the Co's service	7,679 frs.		
In vouchers to 41 depositors whose deposits exceeded 500 francs	15,745 frs.		
		23,424	4,685
Balance in hand Dec. 31, 1876.		129,569	25,915

This sum belongs to 2251 depositors, and represents an average deposit in the six months of 57frs., 56c., corresponding to about 6 per cent. on the salaries received.

The total amount of interest placed to the cred-

it of the depositor's accounts on Dec. 31 last reached the sum of 1780 frs. ($356), which was deducted from the sum realized by the investment of the deposited funds.

Coal.—Although the price of coal has lowered considerably since this time last year, our net price for 1876 was rather higher than that for 1875. The extent of our consumption does not allow us to purchase our coals as we require them; we are obliged to secure our supplies a long time in advance. If this obligation prevents us profiting afterwards by any lowering that may take place in price, it, at the same time, guarantees us against the vexatious results of a rise.

It is, in a great measure, to this circumstance that we are indebted for the progressive increase that has taken place during the past few years in our profits, even when the price of coal, which constitutes nearly half of our working expenses, had very nearly trebled.

For the rest, you will learn with satisfaction that we have lately renewed, on advantageous terms, several of our contracts, which would have expired either this year or in the course of the next.

Retort Coke.—The employment of retort coke for domestic purposes continues to become more general, in spite of the extent to which heating by gas is carried on.

At the commencement of the winter the sale considerably exceeded the production, and we should have been able easily to dispose of our summer stock of coke, if the mildness of the temperature had not caused a diminution in the demand.

Notwithstanding the unfavorable circumstances in which we were placed, our sales of retort coke produced 14,089,688 francs ($2,817,937), differing by only 8,746 frs. from the amount realized in 1875, which reached 14,089,434 frs. ($2,819,687.)

Heating Apparatus.—In the course of the year 1876 we sold 2,301 apparatus for heating by coke, being 332 less than in 1875; this brings the number of apparatus sent out from our works up to 43,032, the whole of which are now, so to speak, in operation in Paris.

These apparatus, which are constructed with special care, are offered to the public at cost price, and have largely contributed to extend the use of coke for domestic purposes.

Tar and Chemical Products.—All the product resulting from the treatment of our tar and ammoniacal liquor are disposed of with great facility, and on advantageous terms. The net result of this manufacture in 1876 was as follows:

	Frs.	Dollars.
Treatment of tar.....	2,567,901	513,580
" of ammoniacal liquor.....	930,008	186,000
Total.....	3,497,909	699,580

Exceeding by 151,289 francs the corresponding amount in the preceding year.

Gas Engines.—The use of these engines is extending slowly. Last year, however, we sold 14 horizontal engines on Lenoir's system, and 48 of Otto and Langen's vertical engines, representing altogether a motive power of 82 horses. These latter engines, which, unlike those on Lenoir's system, do not require the employment of electricity, and also occupy less space, seem destined to render real service in minor manufacturing operations. The number of gas engines in use in Paris on Dec. 31 last was 234, and the quantity of gas consumed by them may be approximately estimated at 800,000 cubic metres (28¼ million cubic feet) annually.

Compressed Fuel.—During the year 1876 we manufactured 31,703 tons of compressed fuel, for the production of which 495,000 hectolitres (1,361,250 bushels) of coke dust were used. The employment of this combustible in our works enabled us to profitably offer for sale a nearly equal quantity of retort coke, instead of consuming it ourselves.

Lecture on Illuminating Gas.

By T. O'Conor Sloane, A. M., Ph. D.

Delivered before the "Xavier Union," April 13, 1877.

[Revised for the "American GasLight Journal," by the Author.]

Previous investigators had tried many experiments with coal gas, had produced jets of flame with it, and made it an object of inquiry and curiosity, but William Murdoch is regarded as the real inventor of our system. In 1792 he lighted his house and office with it, only eighty-five years ago. Its use then gradually extended. Clegg, one of the fathers of the profession, appears on the scene about 1805. In 1814 and 1815 Westminster Bridge and St. Margarets street, Westminster, were lighted with it, in place of the old oil lamps. In 1822 the industry was firmly established in London; fifty-five years from the present time.

Sir Humphrey Davy showed his sagacity, and at the same time his doubt of the resources of mankind, by asking, in ridicule of the new invention, if it were intended to take the dome of St. Paul's for a gas holder. The diameter of the dome is 145 feet. In this city there are two gas holders, each of which is 168 feet in diameter. So you see that Sir Humphrey Davy was perfectly right in his estimation of what would have to be the future size of gas holders, he understated those dimensions, but he was not aware of what would be done only a few years after his time.

Then when houses had to be lit with it, a great difficulty arose to find pipes in which to convey this intangible substance. It is on record that gun barrels were screwed together, and made to serve for conduits. People failed to draw the distinction between a combustible and a heated gas, and were afraid to place the pipes close to wood work, lest it should be set on fire.

I suppose that three or four thousand millions of cubic feet are now annually burned in this city alone. Compare this with the experiments of one hundred and eighty-six years ago, when Dr. Clayton collected it in bladders and burnt it for the amusement of his friends.

Chemistry includes the consideration of all substances in their atomic relations. Like all sciences its first office is the correct division and subdivision of the subjects lying within its scope. So it has divided the world of matter into two grand divisions Organic and Inorganic. The names suggest the old rather than the modern division but they are still retained. Our subject falls under the first head, that treated of by Organic Chemistry, or the Chemistry of Carbon Compounds.

As you know, chemists, by analysis, that is unbinding, have divided all matter into some sixty substances called elements. These sixty form by their combination all the forms of matter that exist on this earth; these forms of matter we can always reduce to them—but there the division stops. We cannot analize, unbind, carbon. We can burn it, that is combine it with oxygen forming carbon dioxide, the gas which escapes from soda water or champagne, but this is synthesis or a putting together—the weight of carbonic dioxide will be much greater than that of the original carbon. Nothing can separate carbon into any two or more substances, no chemical force that has been applied to it has done this. So we call it an element; assume that it exists in the free state in molecules, each molecule containing two atoms. It can enter into combination a half molecule at a time, each atom by itself, but existing as carbon it is assumed to exist as a molecule. This explanation applies to all of the so-called elements.

Carbon you are familiar with. It exists in the free state, mixed with some impurities, in the form of lamp black, charcoal, plumbago or graphite (that is the black lead of pencils), and finally as the diamond. Hydrogen is another of the elements. It is an invisible, odorless, tasteless gas, and the lightest substance known. Carbon unites under certain circumstances with hydrogen. I have alluded already to carbon dioxide, commonly called carbonic acid. This is a combination of one atom of carbon with two of oxygen. Take away the two atoms of oxygen, replace them by four of hydrogen, and you have the compound methane, or marsh gas, CH_4. The black carbon has disappeared; by the agency, in the one case of oxygen, in the other of hydrogen, it has been brought into the gaseous form. The first operation, the combining of carbon and oxygen is easy. Carbon has an intense affinity for oxygen. This combination takes place in all coal fires, and as you are aware the black carbon disappears, it combines with oxygen and goes up the chimney, while the accidental impurities, the ashes, remain in the grate. But to combine carbon with hydrogen is no such easy matter. While we can do it we almost always have recourse to the storehouse of nature for these compounds; compounds of carbon and hydrogen, or hydrocarbons.

All animal or vegetable tissues afford us some, are either composed of them, or evolve them on ignition. Vegetable and animal matter, peat and bituminous and cannel coals when heated evolve large quantities of hydrocarbons. Not only do they evolve hydrocarbons, in addition to these many other compounds are given off. Thus in the case of wood, we find among the products of destructive distillation what is commonly known as pyroligneous acid, which is simply an impure vinegar.

Then hydrogen water, ammonia and many other compounds may be present.

Coal gas is essentially a mixture of hydrogen, marsh gas and a number of more highly carburetted hydrocarbons. It may be made from many substances, but the great and universal source is coal.

It is hard to say how the elements exist in coal. There are present in it, and there combined with each other, carbon and hydrogen. It is a rule among the compounds of these two elements that the more carbon they contain the heavier they are. Thus, in what is called the paraffine series we have $C_{18}H_{38}$ a solid, C_8H_{14} a liquid, and CH_4 or methane, a gas. The general effect of heat upon hydrocarbons is to separate out, dissociate, some of the carbon. This point I will enlarge upon later. The effect of heating coal which contains a large proportion of carbon is therefore to separate out some of it, and to produce compounds which contain less carbon, which are lighter, and assume the liquid or gaseous state. The coal is decomposed by heat; part of the carbon goes off in combination with hydrogen. This includes gases, liquids, and volatile solids. The gaseous part is what we are in search of: the liquid part comprises coal tar and naphtha, and water is also given off, and the volatile solids are present in the tar, naphtha, and water, and are held by them in solution. But a great part of the carbon I have said separates. What becomes of it? It remains in the retort and is removed from time to time, and known to you all as coke. So starting with coal the representative of heavy, or highly carburetted hydrocarbons we have four great classes of products—1st gas, 2nd tar naphtha and water, 3rd volatile solids, 4th coke.

Gas then is made from bituminous or cannel coal by ignition. If we introduce a few fragments of soft coal into a bent tube closed at one end, and then heat the end we shall in a few minutes produce gas which can be collected and lighted. In the manufacturing of gas the ignition of the coal is effected in vessels of clay, called retorts. They are often circular, but very generally ⊓ shaped in section. They are long and narrow—nine feet long and fourteen inches wide for instance. They rest in the furnace in a horizontal position, so that they represent a series of tubes. They are closed or open at the backs. If open they extend clear through the furnace, coming out front and rear, and delivering gas from both ends. If closed they do not go entirely through, are open in front, and deliver gas from there only. This is a matter of detail: you perceive that in either case the coal in them is only heated, it is protected by the retort from the direct action of the flames. These correspond to our tube. The front ends of the retort are furnished with iron mouth pieces. The clay part comes out even with the outside wall of the furnace

an iron mouthpiece of exactly the section of the retort, is attached to it, and comes out some fourteen inches more. From the side or top of it a pipe rises, through which the gas ascends. The front is provided with a lid fastened in position by a screw and cross-bar. The joint between the screw and mouth-piece is made secure by luting; sometimes lead is employed. The retort is kept at a bright red heat, day and night, month after month, without cessation. Every four or five hours the screw is loosened, and the bar and lid removed, and the coke which has been formed in the retort is drawn out. If we break open the tube we shall find in it some of this coke.

We will suppose now that the retort is empty, and standing open. Its interior forms a long red hot tube, very suggestive of cremation. Resting on iron horses directly in front of the furnace, and some eight or ten feet back from it, are two long iron scoops. They are provided with a T shaped handle at the back. They are filled with coal, 100 to 150 pounds in each. Three men, two with a bar which reaches under and across it in front, and one at the cross handle behind, lift one of them. They raise it to the level of a retort, walk forward and place the front of it in the mouthpiece. The man at the back, by himself, or with a charitable push from one of the others, slides it in and turns it over. Out goes the coal upon the bottom of the hot retort. As soon as the scoop is reversed he draws it out. Then three other men in the same way introduce the contents of the other scoop, so that the retort now contains from 200 to 300 pounds of coal. The lid is quickly put on and secured with the screw and bar, and immediately gas comes off. In four to five hours it is drawn and a new charge put in. Thus a couple of retorts can dispose of a ton of coal a day very easily.

The gas mixed with all sorts of impurities rises up through the "standpipe," passes through the "bridge pipe," and down the "dip pipe," into the "hydraulic main." This is simply a large pipe placed on top of the furnaces, and running the entire length of the row, sometimes nearly a hundred feet. The dip pipes pass through its top, and descend to within some six or eight inches of its bottom.

Now, the general statement of the substances produced in the distillation of coal includes liquid products, as you remember. A great part of these collect, condense, in the hydraulic main and form a mixture, and a very disagreeable mixture, of tar and water. The dip pipes descend about an inch into this, and the gas as it is produced has to bubble through it. By a self-acting overflow the level of liquid is kept constant. Thus the gas is prevented from coming out of the retort when it is opened. It is prevented by the dipping of this pipe from rushing out of the mouthpiece.

Hence the gas passes freed from much of its impurities, but still carrying with it a great deal of tar, naphtha, sulphur, ammonia, and water, from which it is desirable to free it. It is first condensed, passed through pipes cooled by the atmosphere or water. This takes out much of the tar, water, and ammonia. Then it goes to the scrubber where it is exposed to the direct action of water, by which much of the remaining ammonia is washed out.

In large works, somewhere in this sequence of apparatus, an exhauster is introduced. This is a species of pump by which the gas is pumped out of the retort, drawn and forced through all this apparatus, and the purifiers and meters, and into the holders. It is not necessary, but is used in all works of any magnitude. The gas is next passed through purifying boxes containing some substance adapted for the removal of sulphur. This is sometimes lime, slaked and spread upon trays. Through this the gas passes and the lime combines with the sulphur and carbonic acid of the partly purified products. Sometimes iron ore is used. This removes sulphur and any ammonia which the scrubber has failed to wash out. Lime removes sulphur and carbon dioxide; iron ore removes sulphur and ammonia: so a balance has to be struck between them, and, on a consideration of their relative efficiency, one or the other employed, or both may be used in succession, one following the other. The gas then passes through meters, sometimes of very large size, which measure it. Then it enters the holder and is ready for consumption.

The gas holder is essentially a tank inverted in a cistern of water. The pipe by which the gas enters, or leaves, descends into the ground outside of the cistern, passes under the wall, and, rising through the water, comes up a foot or so above its surface. The construction can be illustrated by immersing a tumbler, inverted, in water. The air which it contains is perfectly confined. The gas as it enters raises the holder, directed in its ascent by iron guides running along the columns. When the holder is delivering gas it descends.

One of the most curious things about these holders is their extreme lightness. You have sometimes seen them, as you were riding by in some out of the way line of street cars—great black or red cylinders rising up between iron columns—but has it ever occurred to you to ask how thick is the metal of which they are composed? They are supported by the gas which they contain, so the consequence is that thoy are made very thin, not over an eighth of an inch in thickness, generally much less. The weight of a very heavy one is represented by a cylinder of water of the diameter ot the holder and seven inches high. Some have been constructed in England, in London, of enormous dimensions. One said to be the largest in the world is 230 feet in diameter, 85 feet more than the dome of St. Pauls. But New York need not be ashamed of herself while she has the pair of 168 feet holders I have mentioned.

We have seen how gas is made; we have followed it through the successive processes of generation, condensation, washing, purifying, measuring, and storing in the great gas holders. It is now time to examine the substance produced by all these operations, to see what gas is, and how it can be best utilized.

The existence of gas generically considered, that is to say the existence of matter in the gaseous state, is most easily explained by the theory of mutual attraction and repulsion of the molecules of matter. We are all familiar with one substance that exists in the three forms—solid, liquid, and gaseous. It is water; as ice it is solid, as water it is liquid, as steam it is gaseous. This substance, water, is an oxide of hydrogen, a molecule of it consists of two atoms of hydrogen combined with one of oxygen. Suppose then that this, H_2O, represents a molecule of water. It is a center of forces of two kinds, repulsive, and attractive. These are developed or repressed by different circumstances. By heat the repulsive force is made to preponderate, by cold the attractive force increases. In matter in the solid state, the repulsive force is in abeyance, and overcome by the attractive force, so that the molecules are held firmly together. This is the case with ice. Let us then apply heat. I told you that by heat the repulsive force acquired the preponderence, so a point will be reached where one force nearly balances the other, and the matter assumes the liquid form; the ice becomes water. Apply more heat and the repulsive force increases, until it reaches a point wehre it drives the molecules violently apart, and you have steam; an invisible gas. Steam, remember, is not the white cloud which you see rising from a steam pipe, or spout of a kettle; that is condensed steam, and is really water. Steam is quite invisible, and is a perfect gas.

So much for the existence of gas It is matter in which the repellent force is developed so much as to completely overcome the attractive, and produce this aeriform condition of matter. Gases, I am still speaking of gas in general, can affect at least four of the senses. All sounds are due to the vibration of air, which is a perfect gas. Many gases affect the sense of smell; that you all know. They can affect the sense of touch, as we feel the resistance of air in moving the hand rapidly through it. Then gases can sometimes be seen. Iodine is a black substance much resembling plumbago. Heated slightly, the repulsiv- orce becomes greatly increased, and it springs direct ly from the solid into the gaseous state, forming a beautiful violet gas. Bromine forms a brownish red gas, chlorine, a green. These are all elements. It is very doubtful whether gas can be said to affect the taste any more than a solid can be said to. It is probable that a solution is required, that meat of all kinds owe their taste to a rapid solution of some of their constituents, in the juices of the mouth. So gases can affect the taste just as far as solids can. Gases all have weight. A balloon is filled with hydrogen, or a soap bubble is filled with it. They immediately rise, but their rising is due to the weight of air which they displace. Filled with carbonic acid gas CO_2, or air, they would lie on the surface, or, if thrown from an elevation, would fall, because the combined weight of the ballon and gas would carry the whole down.

I have now given you some account of the general properties of gases. They are described as perfectly elastic, and generally invisible; but, as I have shown you, are sometimes very plainly to be recognized by that sense. First among those comprising coal gas come hydrogen. I have described it to you. It is colorless, inodorous, and tasteless. It is the lightest substance known, and is known only in the gaseous condition. It combines with oxygen, and burns, forming water, $2H+O=H_2O$. The flame is nearly colorless and invisible, but possesses intense heating power. This constitutes some 50 per cent. of gas. Next come methane. This is a compound of carbon and hydrogen. Carbon is an element that is very familiar to us all in the solid state. It has been heated to a most intense degree, without furnishing any evidences of volatilization, or even liquefaction. Evidences of these have been reached, but the fact remains, that it is about the most refractory substance known, when it is kept in the free state. But as I stated, on combining it with another element, it may then assume the gaseous condition, existing not in combination with itself, C–C, as a carbon molecule, but as a compound molecule combined with some other element, CO_2 or CH_4. Hydrogen is at one end of the scale. It can not by the greatest pressure and cold be reduced, to the liquld, much less to the solid state. Carbon can not be made to assume any other than the solid state, but under very exceptional conditions. Combine them in different proportions, and taking the paraffine series before quoted, we have $C_{18}H_{38}$, a solid, C_8H_{14} a liquid, and CH_4, and many other gases.

Then methane, or marsh gas, is the next largest constitent. Thirty to forty per cent. is this gas. It exists in nature; in coal mines it appears as the dangeaous fire damp. It burns with a flame that is slightly yellow, but gives little light, Then comes olefiant gas C_2H_4, containing double the amount of carbon. This burns with a very bright flame, and is a most valuable constituent. It ranges from three to ten per cent. The other constituents, many of them deduced rather from theory than actual analysis, are given in the tables.

The sulphur impurities consist in great part of sulphuretted hydrogen and bisulphide of carbon. The gas is all the better for their removal, and the first is so easily disposed of, that it is quite inexcusable to leave any in. It can be detected by exposing paper dipped in a solution of acetate ot lead to a current of gas; if it darkens, sulphuretted hydrogen is present. Sulphur in the gas in the process of combustion forms sulphuric and sulphuric oxides, and does some harm, perhaps, when in inordinate quantities, but is rather a bugbear. In England the law says that no more than twenty grains to one hundred cubic feet shall be present. I have here twenty grains of sulphur, and you see what a small quantity it is.

Ammonia, familiarly known as spirits of hartshorn, may be detected by red litmus, or yellow tumeric paper; the first becomes blue, the second brownish red when moistened and exposed to the gas, if ammonia be present.

We have now delivered to us a gas containing essentially, and for all economic considerations, carbon and hydrogen. Both these substances have a very great affinity for oxygen, and will combine with it,

producing water and carbon deoxide, H_2O, and CO_2. About one-fifth of the air is oxygen; hence this substance will burn, and produce heat. But you remember that I stated that the general action of heat upon compounds of hydrogen and carbon, is to separate carbon, and produce a compound with less of this element. Thus, if we expose olefiant gas, C_2H_4, to heat, it may be supposed to split up: one atom of C is deposited, and CH_4 goes on, a gas. This particular reaction might not take place; I only give it as an illustration. Such a separation of carbon will occur wherever gas is heated to a higher temperature.

Now, starting from the retort, in what part of its existence is gas thus heated? In precisely two places, in the retort, and in the flame. How is it in the retort? The coke is the product of the decomposition of the coal. That will not prove that the gas has been decomposed there. But when clay retorts have been in use for some time, some weeks for instance, an incrustation forms upon their tops; right on the top above the coke. On removal, this appears very hard and black, and is simply carbon in the graphitic modification. You can burn it like coal, if you have a good fire place. This is not derived from the coal, for it is attached, and very firmly attached, to the top of the retort. It is derived from the decomposition of the gas, by the hot walls and top of the retort. Now, as a general rule, all our artificial light is produced by the ignition of solid matter. Gas or liquids ignited may give light, melted iron or steel, are very beautifully luminous, and many gases can be readily made so; but the fact remains that our every day practical source of light is ignited solid solid matter. If, into a non-luminous flame I insert solid matter, it becomes incandescent, and gives light. The solid matter may be a piece of lime, for instance. Let us now examine a jet of gas. The gas is burning, the hydrogen and carbon combine with the oxygen of the air, and form, respectively, water and carbon di xide, the latter a colorless gas. This action can take place only at those parts of the flame to which the oxygen of the air has access, that is the exterior of the flame. What then of the interior? for it has a certain thickness. Here the gas is exposed to intense heat, generated by the combustion. It is protected from the air by the outer zone of the flame, and what should we expect to take place? Separation of some of the carbon. And this is exactly what takes place there. The carbon to some extent does separate But the temperature is very high at this point, and the carbon separated becomes hot, incandescent, or luminous, and it is to this separation of carbon, and to its incandescence that the light of a flame of gas is due.

The gas rises through the burner; as fast as the air can get at it it is burnt, and the carbon disappears, combining with the oxygen of the air; but before it can disappear some of it is separated by heat from its combination with hydrogen, and is for a fraction of a second rendered incandescent. This action takes place over and over again, and the result is a continuous light.

If we take a piece of wire made of the metal magnesium, one of the elements also, and heat it in the air it will take fire and burn. As it burns it will combine with the oxygen of the air, and produce oxide of magnesium, MgO. This is another highly refractory substance. But owing to the heat of the burning wire it becomes incandescent and emits a most powerful light. Now, suppose that oxide of magnesium were the solid substance to which the light of our gas were due, what would be the effect? It cannot be combined like carbon with any element, so as to form an inoffensive gas, so clouds of this white substance would be discharged into the air, and would be very annoying. Whereas the carbon after it has fulfilled its function, the fulfilment taking perhaps not the fifth of a second for each little particle, submits to be burnt, and disappears.

I shall burn a piece of magnesium wire, and catch the oxide of magnesium, or more simply magnesia, so as to show you the solid products of this combustion. You see it is a white solid. I now place a plate in a gas flame, and obtain some of the solid matter present in it; it is black as you see, and is carbon again, or lamp black. This is the direct proof of the existence of free carbon in the flame.

We have seen that the light of gas is due to separated carbon. If we can prevent this separation we will have no light. How can this be done? If we mix gas with air, not too much air, and light the mixture, the carbon will be burnt before it has a chance to separate. There will be no zone of gas protected from the air, a zone whose existence is so essential to light. I have here a burner constructed for that purpose; it was invented by Prof. Bunsen, one of the greatest chemists that ever lived. It is called the Bunsen burner. Air is admitted to mix with the gas by air holes at the bottom of the tube. The mixture of air and gas burns at the top, producing a flame very hot and non-luminous. If I cut off the supply of interior air we again have a smoky luminous flame.

Report of the Department of Public Works for the Quarter Ending December 31, 1876, Bureau of Lamps and Gas.

DEPARTMENT OF PUBLIC WORKS,
BUREAU OF LAMPS AND GAS,
NEW YORK, January 4, 1877.

Hon. Allan Campbell, Commissioner of Public Works:

[Continued from page 188.]

each week, and oftener if necessary. In the winter season snow must be brushed from the frames.

III. The glass street signs must be kept in their proper positions. The sign bearing the name of any avenue or a main street must face the roadway of such avenue or street. One of the signs bearing the name of a cross street must face the roadway of such street, and the other sign must be placed on the opposite side of the lantern. Be careful to observe that the name does not face the inside of the lantern.

IV. If a lighter, on extinguishing the lamp, should find a glass broken, he must replace the same before lighting time of the same day. If he should find a glass broken while lighting, he must replace the same before lighting time of the following day.

V. The burners must be kept in condition to burn with a full, clear, steady flame, and not with a single or forked jet.

VI. If a lighter, when lighting, finds that a lamp will not burn, he will leave such lamp and finish his route. He must then return to the unlighted lamps and endeavor to get them in burning order. If he cannot make the lamp burn he must report the same on the following morning to the superintendent of the gas company.

VII. Lamplighters will not be permitted to climb the lamp posts. The lamps must be lighted either by means of a torch or the use of a ladder.

VIII. In case a lamp post should be found broken, or taken down, or requiring repairs, he must report

EXHIBIT "B."

Statement showing the amount of Vouchers drawn for Gas to the various Public Markets, Offices, etc. and for Lighting, Fitting, and Repairing the Public Lamps, etc., for the Year 1876.

RECAPITULATION.

Public markets, offices, etc.	First Quarte ending March 31.	2nd Quarter ending June 30.	3d Quarter ending Sept. 30.	4th Quarter ending Dec. 31.	Total for year 1876
Gas to public markets, offices, etc	$6,638 60	$4,473 57	$3,758 17	$6,273 46	$21,143 80
Supplies for public lamps	4,511 32	5,328 59	7,769 35	7,541 00	25,150 26
Resetting and repairing lamp posts	618 50	1,472 50	1,667 00	1,626 00	5,384 00
Fitting up new lamp posts	300 00	690 00	1,270 00	1,860 00	4,120 00
Lighting public lamps	100,841 93	134,040 71	115,261 53	156,173 79	506,317 96
Supplies for public lamps, 23d and 24th Wards	54 50	51 00	825 00	1,247 90	2,178 40
Resetting and repairing lamp posts, 23d and 24th Wards	.....	.....	.....	8 00	8 00
Fitting up new lamp posts, 23d and 24th Wards	.. .	.....	.....	430 00	430 00
Lighting public lamps, 23d and 24th Wards	13,424 63	34,303 69	28,642 14	38,246 22	114,616 68
Totals	$126,389 48	$180,360 06	$159,193 19	$213,406 37	$679,349 10

Company.	No. of Lamps burning Sept. 30, 1876.	No. of New Lamps lighted during Quarter ending Dec. 31st, 1876.	No. of Old Lamps relighted during Quarter ending Dec. 31st, 1876.	No. of Lamps discontinued during Quarter ending 31st, 1876.	No. of Lamps burning Dec. 31, 1876.
New York	2,452	..	2	1	2,453
Manhattan	4,111	..	11	1	4,121
Metropolitan	3,691	53	18	20	3,742
Harlem	4,034	79	16	55	4,074
New York Mutual	3,534	1	4	2	3,537
Central	1,534	2	6	2	1,540
Suburban	932	15	..	15	932
Totals for Quarter.	20,288	150	57	96	20,399

For the entire year 1876 the statement is as follows:

No. Lamps at beginning	20,139
New Lamps lighted	459
Old Lamps relighted	379
	20,977
Lamps discontinued	578
Lamps at end of Year	20,399

INSTRUCTIONS TO LAMPLIGHTERS.

I. The lamps must be lighted and extinguished strictly in accordance with the time specified in this time table, and all the lamps must be lighted within one hour from the time of beginning

II. The lamps must be kept clean and in good condition; all the glass shall be cleaned at least twice in the same at once to the superintendent of the gas company, stating the correct location of the post and what repairs are required. If the post has been taken down he must report by whom and for what purpose, and date when done. No excuse will be accepted from any lamplighter who fails to report lamp posts taken down or broken.

IX. Lighters must not break the lamp bottoms, nor the street sign slots. Lamps furnished with these slots should be placed on corner lamp-posts.

X. Ladders must not be left tied to the lamp posts.

S. MCCORMICK,
Supt. of lamps and gas.

EXHIBIT "F."

GRANT TO THE NEW YORK GAS-LIGHT COMPANY.

Articles of agreement, indented, made and concluded, this twelfth day of May, in the year of our Lord one thousand eight hundred and twenty-three, between the Mayor, Aldermen, and Commonalty of the City of New York, of the first part, and the New York Gas-light Company, of the second part:

Witnesseth, That the said parties of the first part for and in consideration of the covenants, articles and agreements hereinafter mentioned on the part of the said parties of the second part and their successors, to be observed, performed, and kept, do hereby grant, demise, and to farm let to the said parties of the second part and their successors, all and

singular the sole and exclusive privilege and right of laying or placing under ground pipes in all and every of the public streets and parts of streets in the City of New York, lying and being south of a line commencing at the East river, at the foot of Grand street, and running through Grand street to Sullivan street, and through Sullivan street to Canal street, and through Canal street to the North or Hudson river, for conducting gas for lighting the public lamps in the streets and parts of streets south of said line, and the houses and buildings fronting or to front on, or bounded by or adjacent to the streets or parts of streets south of said line, to have and to hold and to enjoy the same, unto the said parties of the second part and their successors from the day of the date of these presents, for and during and until the 12th of May, which will be in the year 1853; provided, nevertheless, and this grant is upon this express condition, that the said parties of the second part and their successors, shall and do in all things well and sufficiently keep, perform, and observe all and singular the covenants, articles, agreement and stipulations on their part to be kept, performed, and observed as hereinafter is set forth and agreed; and the parties of the second part, in consideration of the premises, do for themselves and their successors covenant and agree to and with the said parties of the first part and their successors, as follows: that is to say, that they, the said parties of the second part, shall and will, before the 12th day of May, in the year 1825, erect, establish and complete, in the said City of New York, good and sufficient buildings, works, and apparatus for the preparing and manufacture of gas, and that they will also cause the pipes for conducting the same and of sufficient capacity to be laid, and will also manufacture or cause to be manufactured and supplied, in the most approved manner, sufficient quantities of the best quality gas commonly called inflammable gas, for lighting the houses and public lamps in the street called Broadway, in the said city, from the Battery to Grand street, in the manner hereinafter mentioned; and also, moreover, that they, the said parties of the second part, shall and will, at all times, from and after the 12th day of May, in the year 1828, and during the residue of the term of this grant, in like manner cause the pipes, of sufficient capacity for conducting the said gas to be laid, and will also manufacture, or cause to be manufactured and supplied, in the most approved manner, sufficient quantities of the said gas, of the best quality, for well and sufficient lighting the streets and parts of streets and public places, and the public lamps in the streets and houses adjoining or to adjoin all and singular the streets and parts of streets lying in the said city south of the aforesaid line, at such periods as the said parties of the first part, shall, from time to time, after the said 12th day of May, in the year 1828, by resolution or by law, reasonably require of the said parties of the second part, and that all such pipes to be furnished by the said parties of the second part, and placed under ground, for the purpose of conducting the said gas in all or either of the said streets or parts of streets, shall be made and constructed, in the most approved manner, of cast iron, of the best materials; and, also, that the said parties of the second part shall and will light such and so many of the public lamps, with the best quality of gas, as are in the streets or parts of streets of the said city south of the aforesaid line, whenever they may be required to light the same, or any number of the same, by the said parties of the first part or their successors; the said lamps to be lighted during such times as the public lamps are now required to be lighted, and in the streets or parts of streets in which the pipes for conducting gas shall be laid according to these presents, at a yearly expense to the said parties of the first part not exceeding what would be the expense of lighting and supplying an equal number of the said lamps with oil of the quality generally used for that purpose, estimating the price of oil at the average price of the same in the City of New York, during the preceding year.

And, further, that the said parties of the second part shall likewise furnish, at their own expense, the necessary conductors of metal, of sufficient capacity, to the lamp posts, that the light of the said lamps shall be of a quality, brilliancy, or intensity equal to the gas in use for the public lamps in the city of London; the said parties of the first part, however, to be at the expense of lamps, lamp irons, lamp posts, and fittings up, and at no other expense for fixtures, conductors, repairs, or on any other account whatsoever; and, also, that the parties of the second part shall and will at all times give forty-eight hours notice to the said parties of the first, or to the street commissioner, of their intention to break up or open any street or part of a street for the purpose of laying or repairing the pipes to conduct the gas, and that they will replace the earth which they may remove in so doing before sunset of the day on which such opening shall be made, and that they will replace the pavements, and repave and repair the same, in such reasonable time and manner as the said parties of the first part, or their street commissioner, may direct, and in as good and firm a manner as the streets were in before broken for the aforesaid purpose; and, further, that all such repairs as shall at any time become necessary, by reason of the said pipes and conductors, shall always be made and done by the said parties of the second part at their own cost and expense; and, also, that the said parties of the second part will so conduct their manufactory or manufactories of gas as not to create a nuisance, and that they will in all things be governed by such reasonable and necessary rules and regulations as the said parties of the first part or their successors may from time to time pass, ordain and establish relative to the opening of streets, and laying down the pipes and conductors aforesaid; provided, always, that nothing in this grant contained shall be construed to prevent any person or persons residing on, adjacent, or near to any of the said streets or parts of streets in the said city, south of the aforesaid line, from erecting in or on his or their own premises any buildings or apparatus to light with gas his or their own house or manufactory; and provided, further, and the premises hereby granted are also upon this express condition, anything herein contained to the contrary notwithstanding, that if the said parties of the second part or their successors shall not well and faithfully observe, perform, fulfill, and keep all and singular the covenants and conditions above contained, on their part and behalf to be observed, performed, fulfilled and kept, according to the full intent and meaning of these presents, then and in that case it shall and may be lawful for the said parties of the first part, in Common Council convened, by a resolution, to annul and vacate this grant, and thereupon the premises hereby demised shall be revested in the said parties of the first part or their successors, as fully and completely as if this indenture had never been executed.

In witness whereof, to one part of this indenture, remaining with the said parties of the first part, the said parties of the second part have caused the common seal of the said New York Gas-light Company to be affixed, and to the other part thereof, remaining with the said parties of the second part, the said parties of the first part have caused the common seal of the City of New York to be affixed, the day and year above written.

By the Common Council,
[L. S.] STEPHEN ALLEN, Mayor.
J. Morton, Clerk,
September 12, 1831
The New York Gas-light Company, by
W. W. Fox, President.

EXHIBIT "G."

GRANT TO THE MANHATTAN GAS-LIGHT COMPANY.

This indenture, made the fifth day of May, in the year of our Lord one thousand eight hundred and forty-eight, between the Mayor, Aldermen, and Commonalty of the City of New York, of the first part, and the Manhattan Gas-Light Company, of the second part:

Witnesseth, That the said parties of the first part, for and in consideration of the covenants, articles and agreements hereinafter mentioned on the part of the said parties of the second part and their successors to be observed, performed, and kept, do hereby grant and demise to the said parties of the second part and their successors the privilege and right to lay or place underground pipes in any and all the streets, avenues and public places of the City of New York, comprised between a line commencing at the East river at the foot of Grand street, and running through the middle of Grand street to Sullivan street, and through the middle of Sullivan street, from Grand street to Canal street, and through the middle of Canal street, from Sullivan street to the North or Hudson river, and a line commencing at the East river, at the foot of 42d street, on the north side thereof, and running parallel with said street to the North or Hudson river, and embracing both sides of said street, and in any or every part of any such street, avenue, or public place, for the purpose of conducting gas, commonly called inflammable gas, for lighting the public lamps in the said streets, avenues, and public places, and parts thereof, as hereinafter mentioned, and for lighting the houses and buildings fronting, or to front on, or bounded by or adjacent to the said streets, avenues, and public places, or parts thereof, to have, hold, use and enjoy the said right and privilege unto the said parties of the second part, and their successors, from the day of the date of these presents until the 5th day of May, which will be in the year of our Lord 1868. Provided always, and these presents are upon this express condition, that they, the said parties of the second part, and their successors, shall and do in all things well and sufficiently keep and perform, and observe all and singular the covenants, articles, agreements, provisions, and stipulations on their part, to be kept, performed, and observed, as hereinafter specified. And the said parties of the second part, in consideration of the premises, do, for themselves and their successors, covenant, and agree, to and with the said parties of the first part, and their successors, as follows, that is to say: that any gas house or works for the manufactory of such gas, which the said parties of the second part hereafter may use or erect and establish in the City of New York, shall be located, erected, and established on the margin of either the Hudson or the East river, and not south of 14th street in the said city; and that all pipes for conducting the gas which the said parties of the second part may cause to be laid, shall be of sufficient capacity, and made and constructed of the best material of cast iron, and in the most approved manner. That the said parties of the first part shall have the right to order the pipes called the mains of the company to be extended in and along all the streets, avenues, and public places in the said city, within the limits aforesaid, commencing at Grand and Canal streets, and continuing through each street in regular succession. Provided, however, that the said parties of the second part shall not be compelled to expend, in the laying of said mains as last aforesaid, during the continuance of this contract, a yearly sum to exceed $6,000. Also, that the said parties of the second part shall fit up and light all public lamps required by the Corporation, wherever the pipes of the company are or shall be laid within the district aforesaid, and that the said lamps shall be so lighted during such times as the public lamps throughout the City of New York are required to be lighted by the regulations of the said parties of the first part; and that all such public lamps situated within the district aforesaid, shall be so supplied and lighted by the said parties of the second part, at the yearly rate of $15 per lamp, for the light and for lighting and extinguishing the same. Also, that the said parties of the first part may direct and require, by notice to that effect, that all or any portion of said public lamps shall be lighted and kept burning at any other time or times during the continuance of this contract, and the said parties of the second part shall light the same and continue them burning in accordance with any and every direction of the said parties of the first part, or their proper agent or agents, to that effect.

Provided, that if, in compliance with the direction

of the said parties of the first part, the whole number of hours during which the said lamps, or a portion of them, are kept burning in any year shall exceed the average number of hours during which the public lamps in the City of New York have been kept burning during the last five years prior to the date of this contract (which the parties hereto estimate to be and fix at 2,300 hours, then, in that case, the said parties of the second part shall be entitled to claim and receive for such additional number of hours during which the public lamps, or a portion of them, in the district aforesaid, are kept burning, in accordance with such direction of the said parties of the first part, an additional compensation, equivalent to a pro-rata increase in the compensation hereinbefore allowed, proportioned to the increased number of hours beyond the said average number.

The burners in the public lamps shall be equal to those heretofore used in the City of New York, equal to an average consumption of three cubic feet per hour.

And it is further agreed that the said parties of the second part shall furnish at their own expense the necessary conductors of metal, of sufficient capacity, to the lamp posts of such public lamps as they may be required to supply with gas and light as aforesaid.

The parties of the second part shall also fit up the said public lamps, and shall receive as compensation therefor the sum of five dollars for each lamp so fitted up. It is agreed, however, that the cost of the posts, lanterns, and repairs shall be at the expense of the said parties of the first part; and it is further agreed that the said parties of the second part shall have the right to lay pipes at any time within the said district upon giving 48 hours notice to the said parties of the first part, or to the Street Commissioner, of their intention to break up or open any street, avenue, or public place, or part thereof, or to remove any part of the pavement thereof for the purpose of laying or repairing the pipes to conduct the said gas, and that they will replace the earth which they may remove in so doing before sunset of the day in which such opening shall be made, and that they will replace the pavement, and repave and repair the same, in such reasonable time and manner as the said parties of the first part, or their Street Commissioner, may direct, and in as good and as firm a manner as such street, avenue, or public place, or parts thereof, were in before being broken up for the purpose aforesaid. Also, that all such repairs as shall at any time become necessary by reason of laying the said pipes or conductors shall be made and done by said parties of the second part at their own cost and expense. Also, that no such street, avenue, or public place, or part thereof, shall be so broken up or opened, or the pavement thereof removed, or shall be again filled up or repaved, except under the direction and supervision of a competent person, to be appointed by the said Street Commissioner; but the said parties of the second part shall not be called upon to pay any sum to any party or parties for the inspection of any pavement which they may have occasion to replace.

And it is further agreed that the said parties of the second part shall and will so conduct the manufactory or manufactories of gas as not to create a nuisance, and that they will in all things be governed by such reasonable and necessary rules and regulations as the said parties of the first part or their successors may from time to time pass, ordain, and establish relative to the opening of such streets, avenues, or public places, or parts thereof, and laying down the pipes and conductors aforesaid. And it is hereby expressly provided that nothing herein contained shall be construed or deemed as granting to the said parties of the second part any sole or exclusive right or privilege, or as preventing the said parties of the first part from granting the like privileges as are hereby given to the said parties of the second part to any other company, persons, or parties whatsoever, or as preventing any person or persons residing in, or adjacent, or near to any of said streets, avenues, or public places, or parts thereof, lying north of the line hereinbefore first mentioned, from erecting in or upon his or their own premises any building or apparatus to light with gas his or their own house, store, or manufactory, or premises. And it is further covenanted and agreed by and on the part of the said parties of the first part, that the said parties of the first part and their successors shall and will pass all needful ordinances which shall be necessary to protect the interests of the said parties of the second part, and which of right ought to be passed for that purpose.

And it is further provided and these presents are upon the express condition, that if the said parties of the second part, or their successors, shall not well and truly observe, perform, and fulfill, and keep all and singular the covenants and conditions hereinbefore contained, on their part and behalf to be observed, performed, fulfilled and kept, according to the true intent and meaning of these presents, then and in that case it shall and may be lawful for said parties of the first part, by a resolution or order to be passed in Common Council, to annul and vacate this grant, and thereupon the premises hereby demised shall be revested in the said parties of the first part, or their successors, as fully and completely as if this indenture had never been executed.

In witness whereof to one part of this indenture remaining with the said parties of the first part, the said parties of the second part have caused the common seal of the said the Manhattan gas light company to be affixed, and to the other part thereof remaining with the said parties of the second part, the said parties of the first part have caused the common seal of the City of New York to be affixed, the day and year above written.

(Signed) W. V. Brady, Mayor.
By the Common Council,
(Signed)
[L. S.] D. T. Valentine,
Clerk of Common Council.

To the counterpart held by the Corporation of this city is attached the common seal of the Manhattan Gas-light Company, verified by the signatures respectively of the President, David C. Colden, and Secretary,

[L. S.] S. H. Howard.

To be continued.

Discussion on House Drainage.

At the meeting of the "New Haven Engineering Society," held at North Sheffield Hall recently, a paper on the subject of House Drainage was read by City Surveyor, Charles E. Fowler, from which the following abstract is made:

The subject of House Drainage is one that is not as familiar to the general public as its importance deserves. Under this method is treated the most approved method of laying the drains, and the proper arrangement for their ventilation. As a general thing, in our own and in other cities, the work and arrangement of house drains is faulty, both in design and execution. It is not claimed that it is intentionally so, but simply for the reason that the matter is not thoroughly understood. The common plan or arrangement of a house drain as usually carried out here, was to carry the connection from the sewer or cesspool to some convenient point under the cellar bottom, and there connected with the soil and waste pipes from the closets, bath-tubs, sinks, bowls, etc., on the floors above. Usually at each inlet to the soil or waste-pipe, there is placed some kind of a water trap, although not always done. Between the house and the sewer or cesspool there should *always* be placed a proper trap, yet the statement was ventured, that of all the dwelling houses in this city that have drain pipes leading from the interior of the house to the sewer or cesspool, not one-fourth of the number have traps so arranged. This is a very strong statement, and reflects very discreditably upon the intelligence of our citizens; still it is believed to be true. With a house so constructed the result would be a free and unobstructed channel for the foul, impure or offensive air of the sewer or cesspool, to rise in the pipes to the interior of the house, and seeking escape at every crack and opening. And escape it would, for it is almost impossible to make and keep the interior drain pipes air-tight. The exposure of the pipes to the difference in the temperature of the atmosphere on the outside and of fluids on the inside, contraction and expansion, and rendering almost certain the breaking of the cement or filling of the joints of the pipes.

The air which is found in our sewers and in cesspools is hardly such as we would desire to have in our dwellings, and very often it is absolutely dangerous to health. It is believed that there is more danger from the air found in cesspools than in sewers, for in the latter there is circulation and better opportunity for purification. But in either case, for the safety of our lives, its entrance into houses should be prohibited. The air from sewers or cesspools may escape very freely in our dwellings before its presence will be suspected, and that this happens very often there can be no sort of doubt. A large amount of water thrown into the soil or drain pipe will, in most cases, empty the small traps at the sinks and bowls of the house, unless there is some provision for admitting air at the upper end. In cases where there is a trap located between the house and the sewer or the cesspool, in addition to the traps at the inlets to the drain, there is another danger that is overlooked, and that is from the air which may be confined in the drain and soil pipes themselves.

This air, like that of cesspool and for the same reasons, is considered more detrimental to health than that found in the sewers. Whenever a large amount of water is thrown into the pipes a certain amount of air must escape, and it is reasonable to suppose that air confined in such quarters would be impure and unwholesome. If no ventilation or escape pipe has been provided, this air will force the traps at the bowls, etc., where it meets the least resistance. If any portion of the soil or drain is defective or leaky, the foul air will escape at such times, if at no other. Such is the case in many houses in this city, and it is known that many cases of sickness and perhaps death, have been caused by the neglect or carelessness of the owners, builders or designers of our dwelling houses. The remedy for these defects is deemed to be easy of solution and of practical application The drain pipe, soil pipe, branches and all connections *must* be made air-tight, and all reasonable means taken for keeping them so. At every inlet should be located a proper trap. From a point just back of this trap a pipe must be carried up from the drain to the surface of the ground, and there connected with a leader or rain-water spout from the roof. The soil pipe inside the house must be carried up its full size to a point above the roof, as a ventilating shaft. Experience has shown that owing to the warmer atmosphere of the houses, and the consequent heating of the internal pipes, that there is a constant circulation of air through the pipes—coming down the outside pipe and passing up the soil and ventilating pipe—which cannot be otherwise than of great benefit as a purifying agent. Communication should also be established between the ventilating shaft or pipe, and all parts of the branch pipes where there is any danger to be apprehended from confined or stagnant air, bringing the air circulation as near as possible to every trap on the premises. By this arrangement, all stagnation is prevented, the pipes are constantly exposed to the purifying influence of currents of air, and the water-traps throughout the house are relieved from pressure, both of the pent-up air on the one side and the atmospheric pressure on the other.

A number of well-known authorities on the subject were quoted, and explanations of the plan were given by illustrations. Quite a lengthy discussion followed, which was participated in by Professors Brewer, Trowbridge, Norton and Newton, Dr. Linsley, Messrs. Hill, Pierce, Kelly, Ferry and others of the society. The remarks of Prof. Brewer, president of the Board of Health, were especially interesting, and he related several instances of defective workmanship and bad results that had come under his observation.—*Engineering News.*

Chemical and Scientific Repertory.

RESEARCHES ON THE ACIDITY OF THE HUMAN GASTRIC JUICE.—M. Ch. Richet.—The quantity of liquid in the stomach has no influence upon its acidity. Wine and alcohol augment the acidity, but sugar diminishes it. The gastric juice is more acid during digestion than at other times.—*Chemical News.*

A "FIRE-DAMP METER" which may serve to determine the amount of Protocarbide of Hydrogen in a Mine.—M. S. Coquilliot.—The author has contrived two forms of his apparatus, the one for use in the mine and the other for laboratory purposes. Both depend on the principle that hydrogen and its gaseous carbides are completely burnt in presence of oxygen and a palladium wire raised to white redness.—*Ibid.*

ALLEGED POISONOUS COLORS.—The Berlin political papers have brought up a case of inflammation of the eyes produced by knitting with red woollen yarn dyed with "nitronaphtholin." Dr. Reinmann points out that there is no such color in existence, and that binitronaphthol, which may possibly be meant, is a yellow, not a red dye, and is never used in producing a red on wool,—*Ibid.*

A GOOD PLASTIC MATERIAL.—Five parts of sifted whiting mixed with a solution of one part glue, together with a little Venice turpentine to obviate the brittleness, makes a good plastic material, which may be kneaded into figures of any desired shape. It should be kept warm while being worked. It becomes as hard as stone when dry.—*Sci. Amer.*

CONCRETE BRIDGE.—At Seaton, England, a three-arch bridge is being built of concrete, on a new principle invented by Mr. Brannon, of London. The idea of the inventor is that concrete would, for such work, prove far more enduring than stone. The toll house at the end of the bridge is being built on arches. Mr. Brannon suggests that by constructing cottages on arches, instead of on the solid ground, all fear of fever caused by exhalations from the soil would be avoided; and he understood that Sir Walter Trevalyan, on whose estate the bridge was being built, was about to have a number of workmen's cottages built on that principle at Seaton.—*Polytechnic Review.*

NEW APPLICATION OF GLYCERIN.—Mr. A. H. Church reports the following new uses of glycerin in the laboratory: For some time past I have used glycerin for preventing the adhesion of vulcanized india-rubber tubing to the inlet pipes of Bunsen and other gas burners. A drop or two smeared on the parts in contact prevents both surfaces from suffering those changes which give rise to such continued annoyance in the laboratory. The glycerin should be pure.

One of the most serious drawbacks to the use of paraffin lamps for microscopic and other purposes is the perpetual creeping out of some of the hydro-carbon through the cement wherewith the metal burner is fixed to the glass reservoir. If this cement be soaked with glycerin before oil of any kind be introduced into the lamp, this annoyance does not occur.—*Chemical News.*

BREAKING STRAIN OF WIRE ROPE.—The following table showing breaking strain of ropes of 133 wires, is from a pamphlet by Messrs. J. A. Roebling's Sons:

	Diameter. Inches.	Strength. Tons.
No. 1	2¼	74.00
No. 2	2	65.00
No. 3	1¾	54.00
No. 4	1⅝	43.60
No. 5	1½	35.00
No. 6	1¼	27.20
No. 7	1⅛	20.20
No. 8	1	16 00
No. 9	⅞	11.40
No. 10	¾	8.64
No. 10¼	⅝	5.13
No. 10½	9.16	4.27

Public Liberality.

If Mr. Yeomans, the Town-Clerk of Sheffield, has a fault, it evidently consists in his being over-zealous. In 1870, or rather in November, 1869, he, without any authority from the Town Council, issued the necessary notices preliminary to the promotion of a Bill, by which power was sought to effect a compulsory purchase of the Sheffield Gas and Water Companies. Steps were soon taken by the Water Company to restrain the Town Council from expending corporate funds in the promotion of a Bill in Parliament. In the end the question came before the Court of Queen's Bench, and the judges unanimously decided, that as the law then stood, a Corporation had no power to expend public funds on a parliamentary contest. The Town Council, however, having adopted Mr. Yeomans's proceedings, persevered with their Bill, but suddenly withdrew it, when it came before a Committee of the House of Commons. In the meantime heavy costs had been incurred, and the payment of such as could not be deferred, was made by the Town Clerk out of his own pocket. In this way it would appear that he disbursed £7600 of his own money. The question had previously arisen, who was to bear the expenses, and three Town Councillors had become guarantors for the repayment of the money advanced by the clerk. When, however, that unlucky functionary sought to realize his guarantee, the guarantors repudiated. The injustice of this proceeding was recognized by the Town Council, who agreed to levy a "voluntary" rate to raise the money. Being "voluntary," however, most of the ratepayers declined to pay it, and in the end it produced only £2500, leaving the unfortunate clerk still over £5000 out of pocket. In the meantime he has been sued at law, driven into the Bankruptcy Court, and is now practically a ruined main. That is the story which Mr. Yeomans told with "much emotion" to the Town Council of Sheffield at their last meeting. It is a caution to all Town-Clerks.—*London Journal of Gas Lighting.*

Street Lamps in London.

Mr. W. Haywood, Engineer to the Commissioners of Sewers, in his annual report states that, during the last year, tenders were received from the Gaslight and Coke Company for lighting the public lamps. The prices were £4 15s. 9d. per annum for lamps of a square shape, consuming five cubic feet of gas per hour, and £5 for lamps of a circular shape. The difference in the cost of the two is owing to the additional expense in cleaning and maintaining the circular-shaped lanterns. These prices are the same as those charged by the company for the year 1875. The number of defective lights observed during the year was 1186, which is 39 less than in 1875. The returns are made to the Commission by the city police, and include only those lamps in which the defects in lighting are very noticeable. The inspectors again report that the lanterns are cleaned twice a week, regularly, but it would be better if they were cleaned three times a week, and even more frequently during the winter months. Meters are attached to thirty-five of the public lamps, and the meters show that the contract quantity of gas is given at those lamps.

The district inspectors and the inspector of gas lighting are of opinion that the contract quantity is given at all of the lamps, and the gas company state that the regulators have been kept in proper condition throughout the year. The commission, however, have no power to remove these regulators to test them, excepting under certain troublesome conditions, and only where there are meters to the public lamps is there any check upon the quantity supplied. An additional resting place and five-light lamp-post was erected on the crossing at the junction of the Thames Embankment, Blackfriars Bridge, and the western side of New Bridge street. Bartlett's Boulevard lamps, two of which were placed at the corner of Ludgate Circus, and eight in Cannon street, in 1874, not being approved, were removed by order of the Streets Committee in February, 1876. One of Parkman's Excelsior lamps was placed on the Holborn Viaduct Staircase, at the south-east angle of Farrington street. Those erected in June, 1875, on one of the five light lamp-posts in Mansion House street still remain there. These lamps are of one piece of blown glass, supported at their lower extremities by triangular frames fixed to the tops of the lamp-posts. Mr. Skelton was allowed to replace, at his own expense, the reflectors to the catoptric lamps in Cheapside and Moorgate street with reflectors of improved manufacture; they are placed in the tops of the lanterns only, the sides being of glass like the ordinary square lanterns in use in London.—*Journal of Gas Lighting.*

American vs. Provincial Gas Coals.

Upon the relative value of Provincial and American gas coals, we have the following from a prominent engineer connected with gas works at the east:

"That you may have a reliable statement as to the relative value of coals, I give you a statement based upon the workings of the month of March, 1877.

"We will assume as a basis ten tons of coal of each kind, at 2240 lbs. to ton, and we will say the cost for Caledonia from Cape Breton, $5.00; for Youghiogheny, $7,00.

"The average production was for Caledonia 4½ feet, for Youghiogheny 5 feet, for Caledania production 99,000 feet, cost $55. Youghiogheny, Penn or Westmoreland production, 110,000 feet, cost $70.

"Now, if 99,000 feet cost $55, to produce 110,000 feet will cost $61.10. Coke made from 3,444 lbs. of Caledonia coal required to produce the 110,000 feet, 366 bushels. Coke made from 22,000 lbs. of Youghiogheny coal required to produce 110,000 feet, 320 bushels, a gain on Caledonia coal of 46 bushels of coke, at 10 cents per bushel, $4.60,

Cost to purify 110,000 feet gas made from Caledonia coal		6.28
Cost to purify 110,000 ft. gas made from Youghiogheny coal		2.40
	4.60	3.88

This deducted from gain on coke 3,88 leaves 72 cents. The net gain in coke over cost of lime deducted from $61.10, the cost of Caledonia coal, leaves $60.38 to make 110,000 feet from Caledonia coal, as against the cost of $70 for Youghiogheny; a gain of $9.62 on ten tons, or 96 cents per ton.—*Coal Trade Journal.*

The Electric Light.

Much attention is now being given to the improvement of the electric light, with a view to increase its economy and efficiency. The latest improvement reported to the French Academy of Sciences, about a month ago, provides for lights suited to ordinary use. The inventor transmits the powerful current from a magneto-electro machine through the primary helices of induction coils, the current in this case not, however, being continuous, but rapidly reversed in direction by the action of the machine itself. Every reversal of the primary current produces, of course, a spark between the terminals of the secondary or fine wire helices of all the induction coils in the circuit, and these sparks he utilizes in a new and ingenious way. He places between the terminals a piece of kaolin (the clay of which porcelain is made), in such a position that the thick, flaming spark produced by the coil plays over its surface. The result, according to the statement in the *Comptes Rendus*, is a magnificent, luminous band, emitting a light as soft and steady as any that is known, and varying in intensity—according to the dimensions of the coil and strength of the primary current—from the brightness of a single candle to the brilliance of a chandelier of fifteen or twenty burners. The kaolin slowly wastes away, its surface in the track of the spark being worn off at the rate of about one millimeter (1-25 of an inch) per hour. If these reports are to be relied upon it is manifest that a great step has been made, and that illumination by electricity may soon become as common as gas-lighting.—*Iron Age.*

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SATURDAY, JUNE 2, 1877.

Correspondence

[Correspondents, in all cases, should sign their communications with their names and address in full—not for publication, unless desired, but as a guarantee of good faith.—ED.

"Testing Meters."

May 23, 1877.

Mr. Editor: The paper upon this subject, read by Mr. F. C. Sherman, before the New England Association of Gas Engineers at its last meeting, and published in the report of its proceedings, in the GAS-LIGHT JOURNAL of April 2d, contains several valuable suggestions upon a much neglected and very important subject.

Upon one point, however, I think Mr. Sherman is in error, and that is the charge of inaccuracy in large dry meters; so far as the statement applies to a portion of the meter manufacturers in this country, during the last few years, it is certainly incorrect.

And, in any case, why should large meters be more liable than small ones to pass gas without registry?

Does this presumed inacuracy inhere in the large meter from the date of its manufacture?

Or is it the result of a gradual "falling from grace" consequent upon use?

Evidently, Mr. Sherman thinks the latter the case. As to the first question, I can only answer "by authority" for one meter works. In the case referred to, the same stringent rules in regard to the correct measurement of very small amounts of gas—are applied to large and small meters alike. A 300 light meter when it leaves the factory, will register the amount consumed by a single burner as accurately as a 2 light.

Meters, however, of *any size*, after considerable use, may fail to register all—or, indeed, any— of the gas passed; and for the following reasons:

Perforation of the leather of the diaphragms.

Corrosion of the tin partitions to an extent which will permit the passage of gas through them.

By the deposit of tar, or other foreign substance upon the valve seat, thereby tripping the cap.

Other causes affect slightly the accuracy of measurement. But it is not necessary to consider them here.

The entire quotation from Mr. Cathells is slightly mixed. But his statement as to the formation "of a film between the valves", probably refers to the deposit alluded to above.

Now, why the thicker leather of the large meter should be more liable to perforation, or the heavier metal of its partitions be more subject to destructive corrosion than the comparatively thin material employed in the construction of smaller material, we are not informed.

The most frequent cause, however, of partial or entire failure of registry in meters of any size is, in the language of Mr. Sherman, "the lifting of the valve from the seat." Or, as stated above, tripping the cap. But, since the increase in the weight of the cap corresponds with the increase in size, and as the pressure of the gas is, under the same circumstances, uniform in all sizes of meters, it is difficult to see why the loss from this cause should be greater in large than in small ones.

In the case of well constructed, and properly adjusted meters, the percentage of loss will unquestionably be less in the large than in the small sizes.

There is one point in connection with testing meters, which is very important, and which is but little understood, even by those who have given the subject some attention. That is the variation of the registry of meters at different velocities.

It is the general custom to prove meters at a rate of speed corresponding nearly with their medium capacity. But the difference in the registry at the maximum, and the minimum velocity may, *and very often does reach a high figure*, and yet at the speed prescribed its measurement may be exact.

It is not necessary to state the causes which produce this variation in the registry, or to suggest the remedy—it is simple enough—but the conclusion is obvious. All meters should be tested at the minimum, the medium, and the maximum rates of delivery. Meters of any size may register too little with a small consumption, too much at their full capacity, and be correct at some point between the two.

It is quite possible that the charge of inaccurate measurement in large meters may have an apparent foundation in this fact. But this difficulty exists in the smaller meters to as great an extent proportionately, and none should be open to this objection; one maker of meters, at least, is free from it.

In testing meters, *there must be uniformity of temperature* in the elements employed in the test; without this, an approximate accuracy cannot be obtained.

When, from any cause it becomes necessary to disconnect a meter, cork both inlet and outlet tubes carefully, so as to exclude air and dust. If this is done, the meter will be much more likely to work satisfactorily when wanted for use; and if repairs are necessary, it can be put in order at less cost. Finally, if, in the case of a considerable number of our gas companies, *they would make less tar and more gas*, and would attend more carefully to the matter of *purification*, their meters would register more accurately, and be far more durable: and their balance sheet might present a more satisfactory appearance.

SARGENT.

The Economical Applications of Gas.

The novel and unique exhibition of apparatus in which gas is used for other purposes than for illumination, which was conceived by the directors of the South Shields Gas Company, was held in the large hall of the Free Library, South Shields, from April 9 to April 13, having been kept open two days longer than was originally intended, in consequence of the great interest taken in the show by the inhabitants of the town and district. More than three hundred articles were displayed, and it was estimated that over 30,000 persons visited the exhibition. The company had offered seven silver medals as prizes in different classes, and these were awarded by Mr. John Pattinson, analytical chemist, Newcastle-on-Tyne, and Mr. W. H. Bennett, C. E., secretary of the British Association of Gas Managers.

The following list is a summary of the exhibition

CLASS I.

Efficient and Durable Stoves for Boiling, Frying, and Grilling, reliable for a Mechanic's house.

PRUST, J. E., 78 Smallbrook street, Birmingham (Silver Medal), three cookers.

BILLING & Co., London (Honorable Mention), three stoves, hot plates, and boilers.

GOLDSMITH, G., Leicester (Honorable Mention), one workman's cooker, capable of cooking a steak or couple of chops, and half a dozen potatoes in about half an hour, with an expenditure of about 3½ cubic feet of gas.

DAVIS & SON, Bath, a cooking stove and boiling stand.

ECONOMIC GAS RANGER AND HEATING Co. (The), London, a cooking stove and roaster.

LEONI, S. & Co., two stoves, hot plate and grill.

WYNN, J., a registered oven.

CLASS II.

Family Gas Cooking Stoves.

WRIGHT, JOHN & Co., Birmingham (Silver Medal), twelve cookers.

BEVERLEY JOHN & SONS; Leeds (Honorable Mention), one cooker,

BILLING & Co, London (Honorable Mention), two cookers.

LEONI & Co., London (Honorable Mention), ten stoves and boilers.

PRUST, J. E., Birmingham (Honorable Mention), four cookers.

BRADDOCK, J. & J., Oldham, a cooking stove.

DAVIS & SON, Bath, a cooking stove.

ECONOMIC GAS RANGE AND ROASTER Co., London, a range, cooking stove and roaster.

GRAY, JAMES & SON, Edinburgh, two cookers.

THERMOSTETIC STOVE Co., London, two cookers.

WYNN, J., Cheltenham, cooking stove.

CLASS III.

Gas Baths.

WILSON CHARLES, Leeds (Silver Medal), one bath.

COWAN, W. & B., Edinburgh, vapor bath.

DAVIS & SON, Bath, circulating boiler for bath.

EWART & SON, London, one bath.

LEONI, S. & Co,, London, two boilers for bath.

WRIGHT, J., & Co., Birmingham, two baths.

CLASS IV.

Closed Apparatus for Heating Halls or Conservatories either by Hot Air or Water.

WRIGHT, JOHN & Co., Birmingham (Silver Medal), two hot-water apparatus, twelve stoves, and fourteen caloriferes.

DAVIS & SON, Bath, a cylindrical stove.

ECONOMIC GAS RANGE AND ROASTER Co., London, a conservatory stove, two room stoves.

ERZARD, C., Bradford, one stove.

LEONI, S. & Co., London, nine caloriferes.

TANGYE BROTHERS & RAKE, Newcastle, one gas boiler.

CLASS V.

Open Gas Fires.

LEONI, S. & Co., London (Silver Medal), four gas fires and cheerfuls.

BILLING & Co., London, six cheerfuls.

WRIGHT J., & Co., Birmingham, five gas fires and cheerfuls.

CLASS VI.

Gas Engines.

CROSSLEY BROTHERS, Manchester (Silver Medal), a gas engine.

SIMONS & SIMONS, LOUIS, Messrs., of Nottingham, were permitted by the judges to withdraw their engine from competition.

CLASS VII.

Novel Applications of Gas to Articles of General Utility

ERZARD, C., Bradford (Silver Medal), six sets of laundry, tailors, and other irons, so cast as to admit of the heat from a Wallace's burner to pass into and through them.

COWAN, W. & R. Edinburgh, still.

COWAN, W., fomenting apparatus.
DAIZIEL, T., Kilmarnock, horse singer.
GAS FIRE LIGHTER Co., Birmingham, fire lighters.
GOLDSMITH, J. & DILKES, J., coffee roaster, tailor's goose-heating stove, laundry iron-heating stove' etc., in which the gas is so arranged that the weight of the iron when placed in the stove opens the gas tap, and when it is removed shuts the gas-way, so that but a minimum of gas escapes, or only sufficient to light the full burner when required, thus causing great economy of gas.
HEAWORTH, J., Carlisle, calendar heated by gas.
LEONI, S. & Co., two laundry stoves, three tailor's stoves.
MAWSON & SWAN, Newcastle, articles of utility in pursuit of scientific investigation and research in the laboratory, as furnaces, electric burners, thermo-electric pile, thermostat, hot-air blast blowpipe, assaying moulds, in all of which gas is applied.
RENOLDSON, W. J., self-feeding generating apparatus.
ROBINSON, C. S., Leicester, soldering iron heater, with Bunsen burner, fitted with patent gas and air tap; lead-cutting cup, with stand similarly fitted.
TROTTER, H., automatic gas lighter and extinguisher.
WILSON, CHARLES, Leeds, lace singer.
WRIGHT, JOHN & Co., Birmingham, two hot water cisterns, four steamers, one muller, three tailor's stoves, three cigar lighters, one horse singer, one Thoman's stove, two nursery brackets.

During the meeting Mr. W. J. Warner, the engineer of the company, who had suggested the idea of the exhibition, read a short paper on the practical advantages of gas as fuel, &c. In the course of this paper he said: "I do not mean to say that gas can, for all purposes, be placed in competition with coal or coke as a fuel, without reference to the nature of the apparatus or thework to be done. That there is economy in its use for domestic purposes, however, there is abundant proof. I will give you but two facts; one abroad, the other at home. Sir Edmund Hay Currie, chairman of the London Hospital, says 'the gas-cooking system has been carried on for the past six years at this establishment; the waste in cooking is materially reduced, while as to economy, in comparison with other fuel, we have reason to know that the consumption of gas in the kitchen of the hospital (which has upwards of 600 indoor patients and a corresponding staff of attendants) is something over 1,800 feet, representing about 7*s.* per day, the cooking being done on two days in every week partly by gas, and the other five days entirely; 500*l.* a year is the average saving in meat alone. The other fact is this. The consumption of gas during the recent course of lectures upon cooking in this hall was 6,300 cubic feet; the cost was 1*l.* 2*s.* 1*d.*, or 7*s.* a week for the numberless dishes which were cooked; and the whole of the gas registered was not consumed, one of the pipes having been broken during the lectures, and not discovered for some time. It is not solely upon the grounds of economy that the use of gas is recommended for domestic purposes, but also upon its controllability, and, therefore, its adaptability to all domestic requirements—it will cook an ox as well and with as much ease as a beefsteak, or drive a steam-engine as well as it will simmer a little beef tea. On talking over this matter with a kind exhibitor, Mr. Swan, of Newcastle, he said to him it always appeared that the distribution of gas was the perfection of civilization; but, he added, 'we burn it like heathens.' This brings me to another point, upon which I may give you a word of advice; do not believe what some makers and others will tell you about a flue; such is just as necessary with gas as any other kinds of fuel. With apparatus for warming apartments, the products of combustions, however, may be, and should be, kept quite out of the apartments; hence the beautiful adaptability, and the uniformity of temperature that may be maintained, by gas for the heating of apartments. In the heating of baths there is another requirement—expeditiousness; in this gas stands pre-eminently alone. This quality is absolutely essential for an occasional fire. With most English people, too, sight as well as feeling must be gratified. For as drawing-room in changeable weather, or on a chilling summer evening, the open 'cheerful' gas-fire answers its purpose most admirably. Just as safely and as easily, without soiling the fingers, the lady may, after lighting her drawing-room fire, descend to the offices and start an engine to do the drudgery of her household. As a source of power either indirectly, as applied to a boiler for raising steam, or directly by the explosion of the gas, we have a motive power that will at no distant day be generally applied wherever a gas-pipe is laid.

In the apparatus exhibited it will be observed that the energies of the designers have not been exclusively directed to the principles of construction, the form and configuration have been much improved; there is an excellent display of artistic talent. The manufacturers have well responded to our invitation to produce a cheap stove for the million; there are marvels of cheapness displayed. If the blessing of gas-cooking do not fall equally upon the poor as the rich, it will not be the fault of the manufacturers. Besides those things which the exhibition was intended to make you familiar with, others will be found exhibited of a most interesting character. The calendering machine, useful to dyers and others, exhibited through the kindness of Mr. Hepworth, of the Carlisle Gas Works, whose invention it is, does excellent work. There is, too, the beautiful singeing machine of Mr. C. Wilson, the patentee, Leeds, which shows, as nothing else can, the perfect controllability of gas-flames to perfect and finish the beautiful productions of the lace manufacturers, the loose fibres of the lace being burnt off by passing the lace through a gas-flame. Mr. Swan, of Newcastle, exhibits some of the most interesting articles—one, a beautiful application of pure science to the common requirement of everyday life. The apparatus is called a thermostat; it is for the purpose of maintaining a uniform temperature, to within a degree by means of an electric current. There are also the interesting contrivances of Mr. Cowan and Mr. Morrison, of Edinburgh—water still, vapor bath, and gas furnaces. Can I say more to interest you in this exhibition? The gas-pipes appear to be not only the 'perfection of civilization,' but the conduits of mighty forces—light, heat, power—the elements of which were created, gathered, and stored by our heavenly Father throught long past ages to refine, elevate, and bless mankind."—*Ironmonger.*

Proposed Standard Photometer for Measuring the Illuminating Power of Gas.

The Tenth Annual Report of the Warden of the Standards (for the year 1875-6), made to the Board of Trade, and laid before Parliament, has just been published, and from it we extract the following remarks in reference to the above proposition:

* * * * * * * *

A brass standard scale, accurately graduated, has recently been constructed by Messrs. Troughton and Simms for the Standards Department, with a view of its being constituted the standard of the 60-inch graduated bar employed in the photomer, now generally used for testing the illuminating power of gas, known as the Letheby-Bunsen photometer. The figures engraved on the scale, corresponding with the several graduated lines, are meant to show the illuminating power of the tested gas expressed in number of standard candles, according to the relative distance of the gaslight and the two standard candles from the opaque disc previously described. The distance of each division, from the end of the 60-inch bar, is computed from the principle that the illuminating power of a light decreases in proportion to the square of its distance, and is found from the formula

$$60 \frac{\sqrt{c}}{1+\sqrt{c}}$$

where *c* represents the division of the scale expressed in standard *candles*, the legal unit of the illuminating power of coal gas under the Metropolis Act of 1860.

This standard photometer scale has now been carefully verified as to the accuracy of the several graduated lines marked upon it.

A similar standard photometer scale was verified last year in the Standards Department for the Government of Canada, the 60-inch Letheby photometer having been legalized by the Canadian Legislature as the instrument for determining the illuminating power of gas throughout the Dominion.

The brass bar upon which the graduated scale is engraved is 60 inches long, 2 inches wide and half an inch thick, reduced in weight by one of the 2-inch wide surfaces being bevelled off three-fourths of its width.

The graduated lines with the figures denoting the number of candles and half candles are engraved at the following distances *from each end of the bar*, commencing with 1 at the middle of the bar:

Candles.	Inch.	Cdls.	Inch.	Cdls.	Inch.
1 equal	30·00	11 equal	46·10	21 equal	49·25
1½ "	33·03	11½ "	46·34	21½ "	49·36
2 "	35·15	12 "	46·56	22 "	49·46
2½ "	36·76	12½ "	46·77	22½ "	49·55
3 "	38·04	13 "	46·97	23 "	49·65
3½ "	39·10	13½ "	47·16	23½ "	49·74
4 "	40·00	14 "	47·35	24 "	49·83
4½ "	40·78	14½ "	47·52	24½ "	49·92
5 "	41·46	15 "	47·69	25 "	50·00
5½ "	42·06	15½ "	47·85	25½ "	50·08
6 "	42·61	16 "	48·00	26 "	50·16
6½ "	43.10	16½ "	48·15	26½ "	50·24
7 "	43·54	17 "	48·29	27 "	50·32
7½ "	43·94	17½ "	48·42	27½ "	50·39
8 "	44·33	18 "	48·56	28 "	50·46
8½ "	44·68	18½ "	48·68	28½ "	50·53
9 "	45·00	19 "	48·80	29 "	50·60
9½ "	45·30	19½ "	48·92	29½ "	50·67
10 "	45·58	20 "	49·04	30 "	50·74
10½ "	45·85	20½ "	49·15		

The lines on the brass bar defining these several distances have been compared with our subdivided standards of length, and have been found correct.—*Journal of Gas-Lighting.*

Gas-Light Intelligence.

United States.

GAS FROM SAWDUST, ETC.—A San Francisco man thinks he can make good burning gas from sawdust, tar, rags, old leather, bones, and such truck. Hand-organs and goats are not down on the list; and we advise him to improve his process and bring them within his patent.—*Exchange.*

ELECTION OF OFFICERS OF THE AMERICAN METER COMPANY.—At a recent meeting of this company the following officers were elected for the ensuing year:

President and Gen'l Sup't.—Thos. C. Hopper.
Vice-President.—William H. Hopper.
Treasurer.—William N. Milstead.
Secretary—William H. Down.

GAS COMPANY ELECTION.—The new Board of Directors of the Cincinnati Gas-Light and Coke Company, J. F. Torrance, W. W. Scarborough, A. D. Bullock, A. Hickenlooper, John Shillito, C. W. West, and A. H. Hinkle, yesterday elected President, in place of Mr. Scarborough, who did not desire re-election, A. Hickenlooper, formerly Vice President of the company.—*Cincinnati Daily Times, May* 9th.

EXHIBITION OF GAS APPARATUS.—The South Shields (England) Gas Co. is entitled to credit for having inaugurated, with perhaps commercial as well as philanthropic motives, a novel kind of exhibition, confined to apparatus illustrating domestic and commercial applications of gas. They distributed seven silver medals among the exhibitors. No doubt, if other gas companies follow the example, the use of such apparatus and the consequent consumption of gas will be largely stimulated.—*Ironmonger.*

A report of this show will be found elsewhere.

GRASS AS WELL AS GAS.—Extensive improvement have lately been made at the works of the Zanesville Gas-Light Company, North Sixth street. The square plat between the two principal buildings has been nicely sodded, and the walks dressed up so that the place presents more the appearance of a lawn, than the "front yard" of a gas works. Around the new receiver plats of green grass are to be seen, placed at intervals, as though a landscape gardner had been trying his hand on beautifying the retreat of a country gentleman. Superintendent Printz has an eye for the beautiful as well as the practical—grass as well as gas.—*Zanesville Courier.*

Fire-Clay.

A Line of Manufacture in which St. Louis is Unsurpassed.—Our Inexhaustible Deposits of Fire Clay—Leading Manufacturers.

[From the "Missouri Republican."]

In the immediate vicinity of St. Louis are the most valuable deposits of fire-clay in the world. Some of the deposits have been worked for twenty-five years, but the deposits are inexhaustible. The superior quality of the material is shown by the fact that it is shipped in a crude and prepared state to all parts of the United States for manufacturers purposes.

The process of making fire-clay goods has been brought to a high state of perfection by our St. Louis manufacturers, and a variety of the higher grades of articles which were formerly brought from the East and Europe are now made here. Gas retorts for the entire West and South are supplied from this point, and the crucibles used in our glass factories are now made here. Thus the quality of the material and the improved methods of manipulating it in use here combine to make St. Louis an unrivalled market for this class of goods.

THE CHELTENHAM FIRE-CLAY WORKS.

This establishment—where all the celebrated Evens & Howard brands are made—has for twenty-two years stood at the head of this line of manufacture. From the small factory started by Charles P. Chouteau in 1855, it has steadily enlarged until now it is not only one of the largest, but the most perfectly-equipped manufactory in the country, and represents an investment of $200,000. The works were destroyed by fire in January, 1875, and in rebuilding no expense was spared in order to secure the most modern machinery for the new buildings. The result of improvements then made was shown the following year, when Evens & Howard secured the contracts for the gas retorts required for Chicago and Cincinnati, against the competition of all the large manufacturers of the country.

Perhaps the most interesting point in relation to these works is the great care with which the material is handled. As the clay is taken from the mines it is separated into three masses, according to quality. From this time forward the care is never relaxed until the manufactured articles are packed on the cars. Sometimes men are working it over, picking out injurious materials; again it is being plowed or harrowed to expose it to the mellowing influence of the sun, or it is being ground or washed or kneaded with the same care a baker gives his dough, and so on for two years it is under constant care. They manufacture all grades of fire clay ware, and only the "cream of the mines" is used for glass pots, gas retorts and fire brick; the ordinary grades which vitrify at lower temperature being best adapted for sewer-pipe are used for this purpose. Their facilities for making this discrimination are unequalled. A visitor in passing through the works is impressed with the spirit of progress manifested on all sides. Here is a brick making machine of French patent, purchased at the Centennial; alongside the railway switch is a newly-constructed bin for loading cars with clay in bulk, thus dispensing with the cost of barrels; in another place is the washing department for washing the clay for finer grades of work—and so on every hand is noticed the continued effort to improve.

The factory consists of three works located at Howard Station, Missouri Pacific R. R., four miles from the city, and connected with the entire railway system of the country. Goods are packed in cars and shipped to all points without breaking bulk, a saving both in cost and wastage. The factory is managed by competent engineers, educated expressly for this work, the entire force being in charge of Supt. E. T. Howard, who is considered the best posted man in the West in regard to the processes of manufacture and the wants of the trade. The company's success is due in a great measure to the discrimination used in employing labor and the experienced supervision constantly exercised.

The Evens & Howard goods cover the whole range of fire-clay articles. They carry a larger and better assorted stock than any other manufacturers, so that orders may be filled without delay. They keep on hand three grades of fire-brick, one for iron and steel furnaces and gas works, one for lead furnaces and another for jobbing purposes. They also make to order fire-brick of all sizes and shapes, for any kind of a manufactory; their sewer and water-pipe ranges from one inch to thirty inches calibre; their gas retorts have superceded all others in the West and South. The material used is the best in the country, the crude clay from their mines being used for glass crucibles throughout the United States and Canada. As the company use only the clay from their own mines, the trade may be assured of the uniform quality of their goods. They ship a large portion of their goods to Philadelphia, Pittsburgh, Chicago and all western and southern states. Their city office and depot are at 916 and 918 Market street. The company have a clean record of success in the increased favor with which their goods are received, after many years of test and trial and in the steady enlargement of their business operations.

In the manufacture of tuyeres for Bessamer converters to stand a heat of 17,000 degrees; they have achieved an enviable reputation, and in fact in all branches of fire-clay work they are exceedingly successful.

They manufacture clay gas retorts, gas house tiles and settings, blast-furnace linings, vitrified sewer-pipe, drain tiles, grate tiles, glass pot clay, silica brick, No. 1 brick for Siemens' furnaces, rolling mills, gas works, glass works, lead refining works, lime kilns, silica blocks for foundry cupolas, Bessamer tuyeres, cupola linings, boiler tiles, green house tiles, fine ground brick, fine ground fire clay, fire sand, washed fire-clay, etc., etc. Portland and the hydraulic cements constantly on hand. 431-1t

Prices of Gas Coals.

We continue our quotations for standard gas coals.

Westmoreland	$5 50	$4.50 } at Baltimore.
Penn	5.50	4.50 }
Despard	5.35	
Marion	5.35	
Murphy Run	5.35	
Ches. and Ohio R.R. Caking Coal	5.40	4.25 at Richmond.
Block House	4.50	1.75 } Gold f. o. b. at Mines.
Glace Bay	4.25	1.50 }
International	4.25	1.75 }
Clover Hill	4.00	
Newcastle	4.25	
Cannelton Cannel	10.00	
Peytona	10.00	

Since our last issue some additional contracts have been made, principally for Westmoreland and Penn coal: the aggregate sales up to the present time have been far below those of former years, notwithstanding the fact that prices are lower than ever before known. The excessive supplies carried over from last year will reduce the volume of business this year fully one-third from that of 1875, and still furnish ample stock for the consumers until May or June 1878. The facilities now afforded by the leading coal companies for delivering coal at short notice all through the year, renders it unnecessary for gas companies to carry such heavy supplies as in former years, a very considerable saving is thus effected in interest, storage, and depreciation in quality.

It is reported that two or three cargoes of Newcastle coal are coming forward, the freight limit under which they were ordered having been secured. The currency cost of this coal delivered in New York is not far from $4.25.

There are some 5000 tons of Block House coal in transit to New York, imported under orders from the different gas companies in that city. We note the clearance of the bark "Edwin" from Little Glace Bay for Baltimore with gas coal. This is the first importation of provincial coals into that port, for gas purposes; its cost there is materially less than that of American coals, although the latter are in direct communication with the mines in West Pennsylvania and Virginia.

Freights from Baltimore to ports east of Cape Cod are $1.70, making the cost of the gas coals in these markets about $6.20.

A New Motor.—Dr. Potter, of Griffin, Ga., has a new motor which promises to lay Keely's entirely in the shade. With it, it is said, he can generate electricity in quantities heretofore unparralled, and with this he proposes to decompose water into a vapor or gas many times more powerful than steam, which is to be used in propelling machinery. By the same motor he proposes to generate a burning gas, which will make the illumination of streets and houses nearly as cheap as moonshine.—*Telegram.*

Gas Stocks.

Quotations by W. B. Scott & Co., Bankers,

24 Pine Street, New York City.

June 2, 1877.

☞ All communications will receive particular attention

	Capital.	Par.	Bid.	Asked.
Gas. Co.'s of N. Y. City.				
Central, Westchester	466,000	50	90	95
Harlem	$1,850,000	50	100	105
Manhattan	4,000,000	50	200	205
Metropolitan	2,500,000	100	135	137
" Scrip	$1,000,000	...	100	103
" Bonds	500,000	1000	92	94
Mutual	5,000,000	100	92	94
" Bonds, gold.	900,000	1000	105	—
Municipal	1,000,000	100	70	80
New York	4,000,000	100	133	125
Saugerties, N. Y	15,000	100	110	115
Gas Co.'s of Brooklyn.				
Brooklyn	2,000,000	25	160	163
Citizens	1,200,000	20	87	90
" Scrip	320,000	1000	95	97½
Peoples	2,000,000	10	40	45
" Bonds	$ 325,000	...	—	95
" Scrip	300,000	...	85	—
Metropolitan	1,000,000	100	—	75
Nassau	1,000,000	25	80	85
" Ctfs.	700,000	1000	96	98
Williamsburgh	1,000,000	50	120	125
" Scrip		...	98	100
Out of Town Gas Companies.				
Bath, Maine	70,000	100		
Buffalo Mutual, N. Y	750,000	100	55	—
" Bonds	200,000	1000	—	90
Baltimore, Md	2,000,000	100	134	134
" Ctfs., gold	1,000,000		106	110
Bayonne, N. J		100		90
Brockport, N. Y	25,000	100	...	80
Citizens, Newark	918,000	50	98	100
" " Bds.	124,000	—	—	—
Cincinnati G & C Co				190
Derby of Conn	160,000	100	60	80
East Boston, Mass.		25	132	—
Fort Wayne, Ind		100	...	—
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	184	186
Hempstead, L. I	25,000	100	...	—
Jersey City	386,000	20	160	—
Jamaica, L. I	25,000	100	...	—
Jacksonville, Ill	120,000	50	82	...
Lewistown, Maine	400,000	100	50	85
Lima, Ohi'o	60,000	100	—	...
Bonds	30,000		90	
Laclede, St Louis Mo	1,200,000	100	100	110
Long Branch		20		95
Peoples, Jersey City		...	120	125
Peoples of Albany	650,000	100	—	20
" Bonds	350,000	1000	—	—
Peoples of Baltimore		25	76	—
" Bonds			106	—
Perth Amboy		25	—	95
Rochester, N. Y		100	50	60
Richmond Co., S. I.	300,000	...	97	100
Woonsocket, R. I.	150,000	100	100	...
Halifax N. S	400,000	40	148	150
Hamilton, Ontario	150,000	40	117½	
San Francisco Gas-Co., S. Fr'isco Cal.			111	112
St. Louis, Missouri	600,000	50	73	75
Stillwater, Minn	50,000	50	—	26
Suburban, W'stch'str	390,000	50	—	100
Troy, Citizens	600,000	100	—	60
Toledo, Ohio			95	97½

Seventeen shares of Williamsburgh Gas Light company's stock, at auction, at 121.

Advertisers Index.

GAS ENGINEERS.

	Page
William Farmer, New York City	222
James H. Walker and Son, Milwaukee, Wis	222
George W. Dresser, New York City	222

GAS WORKS APPARATUS AND CONSTRUCTION.

John P. Kennedy, New York City	223
Herring & Floyd, New York City	223
T. F. Rowland, Greenpoint, L. I	223
J. W. Starr & Son, Camden, N. J	223
Delly & Fowler, Philadelphia, Pa	223
Kerr Murray, Fort Wayne, Ind	223
George Stacey & Co., Cincinnati, Ohio	223
Brown & Owen, Philadelphia, Pa	223

GAS AND WATER PIPES.

McNeals & Archer, Burlington, N. J	218
Gloucester Iron Works, Philadelphia, Pa	218
Campbell, Brick & Co., New York City	218
James Marshall & Co., Pittsburgh, Pa	218
R. D. Wood & Co., Philadelphia, Pa	218
S. Decatur Smith, Philadelphia, Pa	218
H. R. Smith & Co., Columbus, Ohio	218
William Smith, Pittsburgh, Pa	218
B. S. Benson, Baltimore, Md	218
McNab & Harlin Manufacturing Co., New York City	218

PIPE CUTTING MACHINES.

A. C. Wood, Syracuse, N. Y.	221

RETORTS AND FIRE BRICK.

Geo. C. Hicks & Co.	226
Evans & Howard, St. Louis, Mo	221
J. H. Gautier & Co., Jersey City, N. J	220
B. Kreischer & Son, New York City	221
Adam Weber, New York City	220
Gardner Brothers, Pittsburgh Pa	220
Brooklyn Retort and Fire Brick Works	220
Cathels Retort Settings	220

GAS METERS.

Harris, Griffin & Co., Philadelphia, Pa	224
American Meter Co., Philadelphia, Pa	225
W. W. Goodwin & Co., Philadelphia, Pa	225
Harris, Helme & McIlhenny, Philadelphia, Pa	225

VALVES.

Chapman Valve Manufacturing Co., Boston, Mass	204
Ludlow Valve Manufacturing Co., Troy, N. Y	217
Union Hydraulic Works, Philadelphia, Pa	220

EXHAUSTERS.

P. H. & F. M. Roots, Connersville, Ind	220
Smith & Sayre Manufacturing Co., New York City	224

GAS COALS.

Penn Gas Coal Co., Philadelphia, Pa	291
Provincial Gas Coals, Perkins & Job, N. Y. & Boston	219
Waverly Coal & Coke Co., " " " "	219
Cannelton Coal Co., " " " "	219
New York & Cleveland Gas Coal Co., Pittsburgh, Pa	219
Newburgh Orrel Coal Co., Baltimore, Md	219
Despard Coal Co., Baltimore, Md	219
Tyrconnell Coal Co., Baltimore, Md	219
Peytona Coal Co., New York City	219

COKE SHOVELS.

Butler's Patent, New York City	224
New York Shovel Co., New York City	224

BURNERS.

C. H. Meyer & Co., Philadelphia, Pa	222
C. Gefrorer, Philadelphia, Pa	222

PROCESSES.

Gale & Rand, New York City	217
Gwynne Harris, New York City	217
Wren, Brooklyn, N. Y	223
Lowe, Philadelphia, Pa	223

GAS FIXTURES.

Mitchell, Vance & Co., New York City	222

HYDRAULIC ELEVATORS.

Lane & Bodley, Cincinnati, Ohio	222

GAS STOVES.

Retort Gas Stove Co., Providence, R. I	217

CEMENT.

S. L. Merchant & Co., New York City	225

GAS WASHERS.

E. S. Cathels, New York City	225

CARBON IN RETORTS.

G. W. Edge, Jersey City, N. J	194

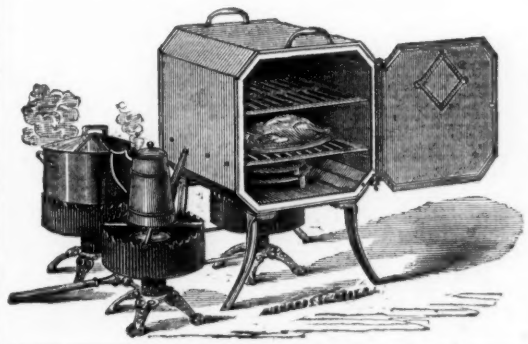
FOR SALE.

Bench Castings, Brooklyn Gas Co	194
Experimental Holder, New York Gas Co	221
Coal Gas Works	221
Half Interest in Gas Works	224
Fodell's Book-Keeping	225
Kidd's Guides	218

GAS MACHINES.

Walworth Manufacturing Co., Boston, Mass	219
Springfield Gas Machine Co., New York City	217

THE RETORT GAS STOVE,



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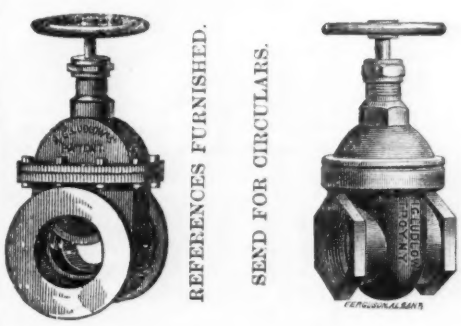

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AND
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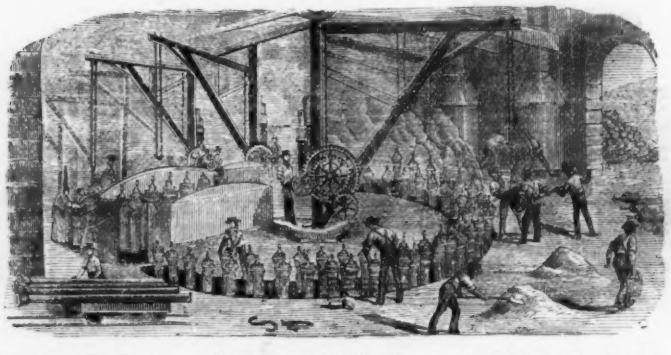

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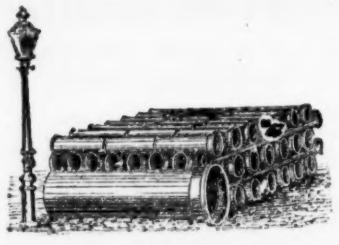

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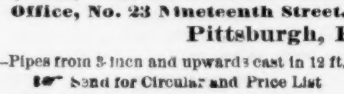

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351-1y

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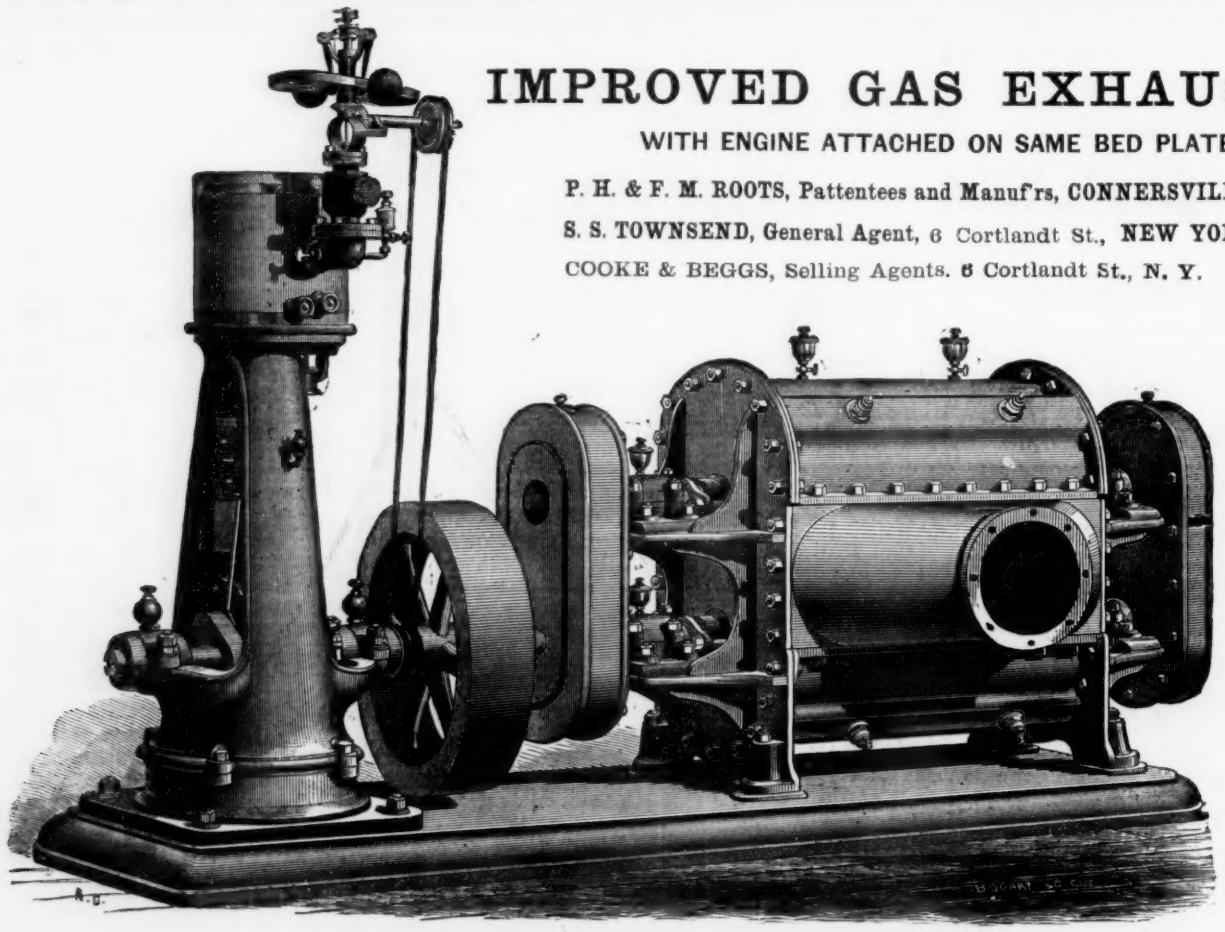

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AND

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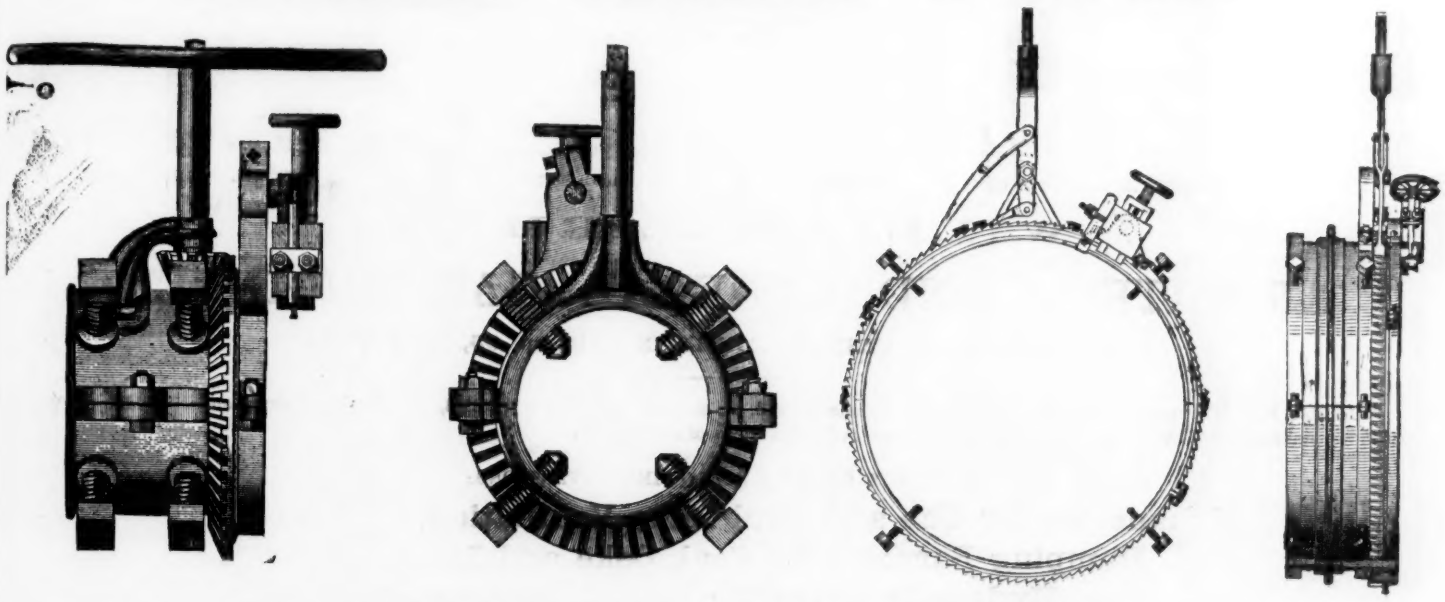

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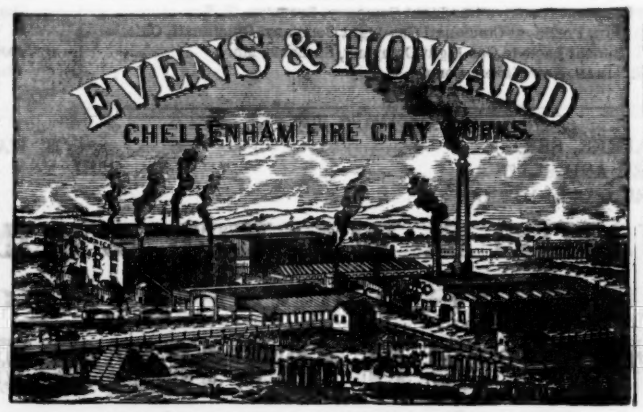

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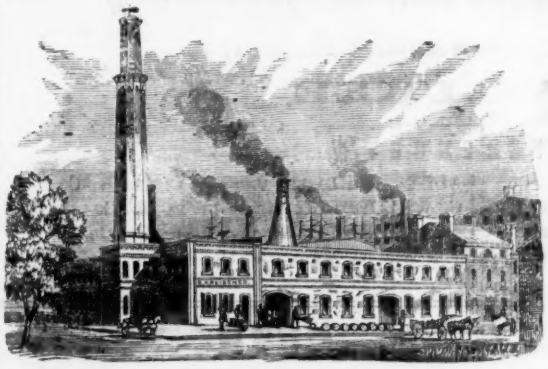

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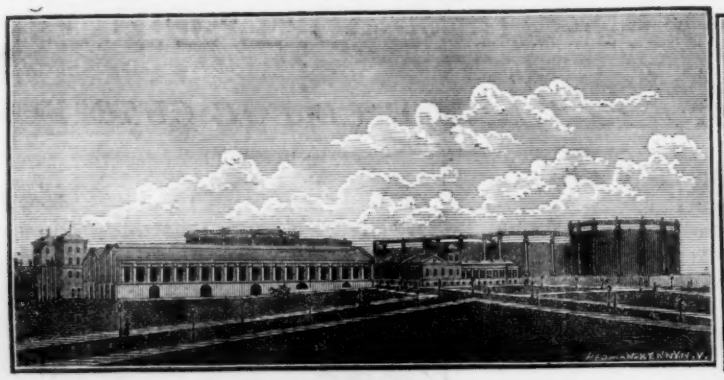

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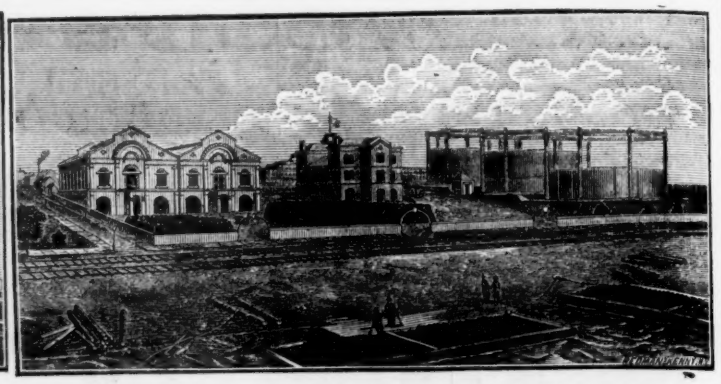

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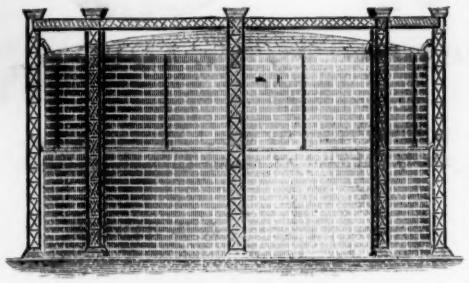

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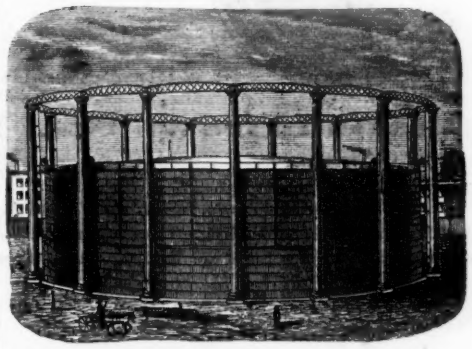

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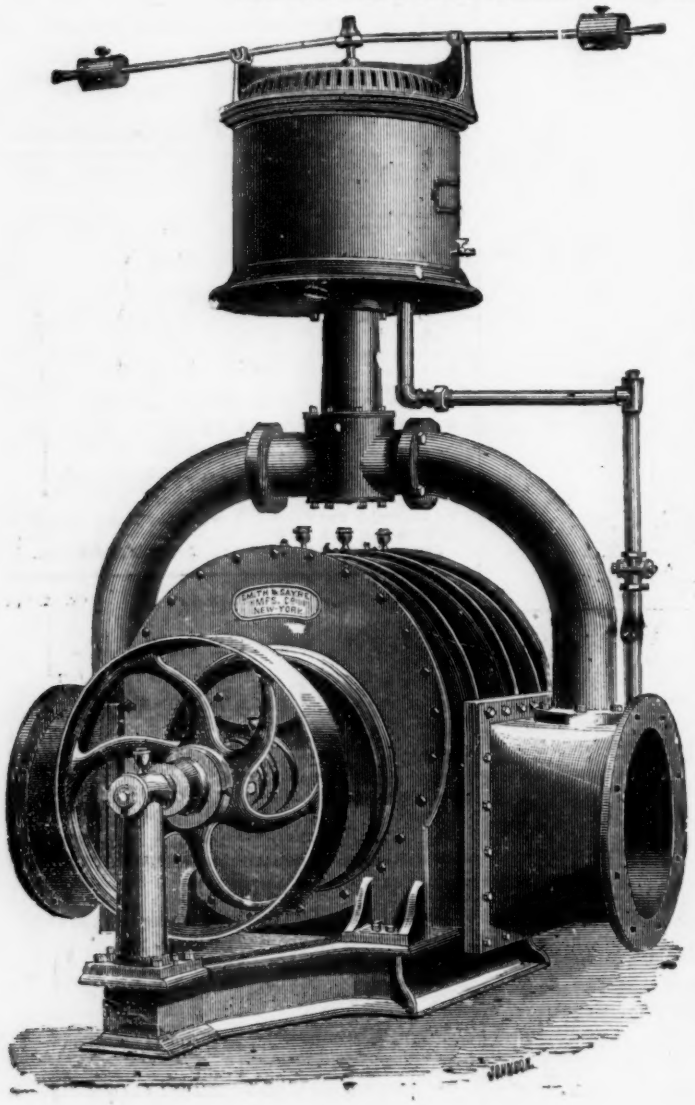

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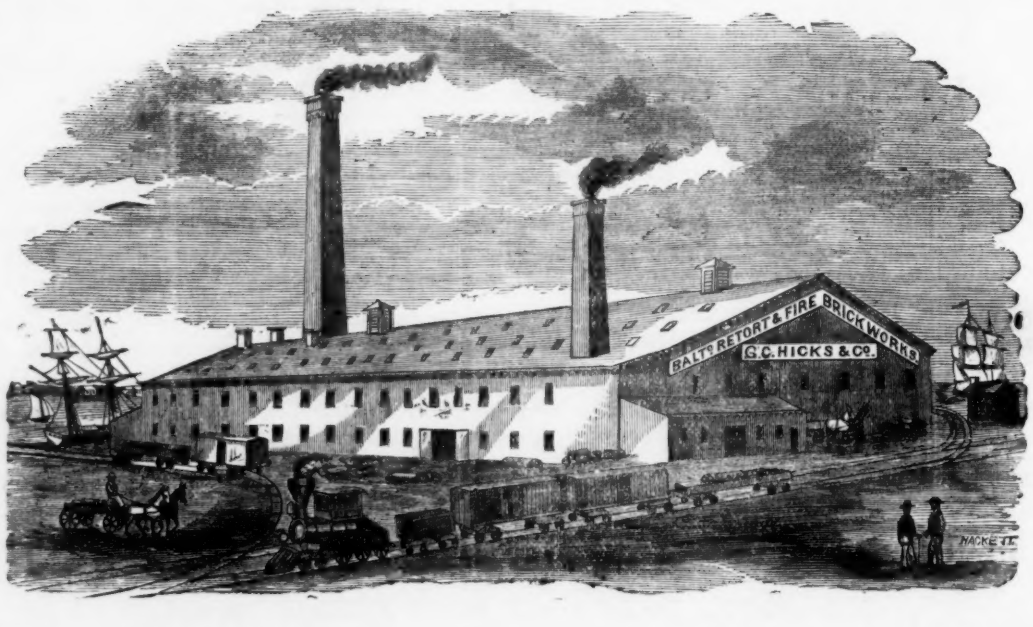

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